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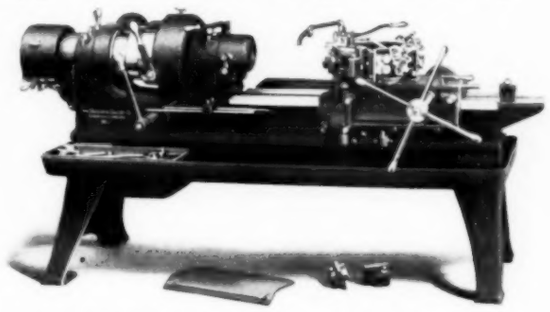
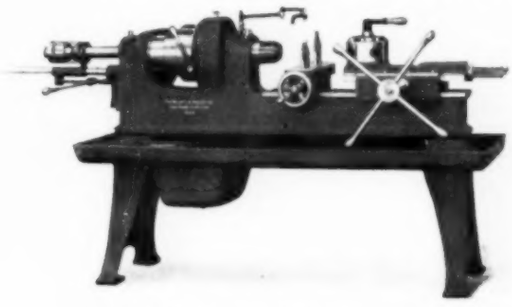
Index to Advertisers and Classified Index Following Reading Matter.

WARNER & SWASEY TURRET LATHES

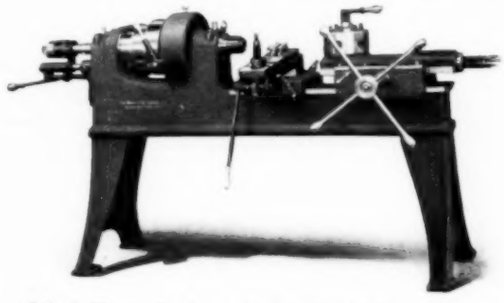
Types and Sizes for Every Requirement—Bar or "Chuck" Work



No 2 Hollow Hexagon Turret Lathe. Four Sizes



No. 4 Turret Screw Machine. Eight Sizes



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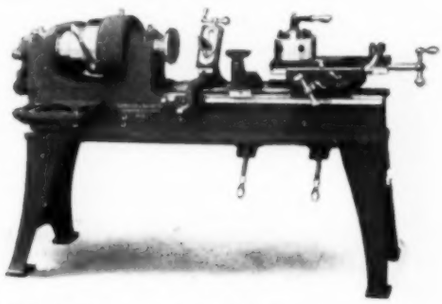

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THREAD MILLERS

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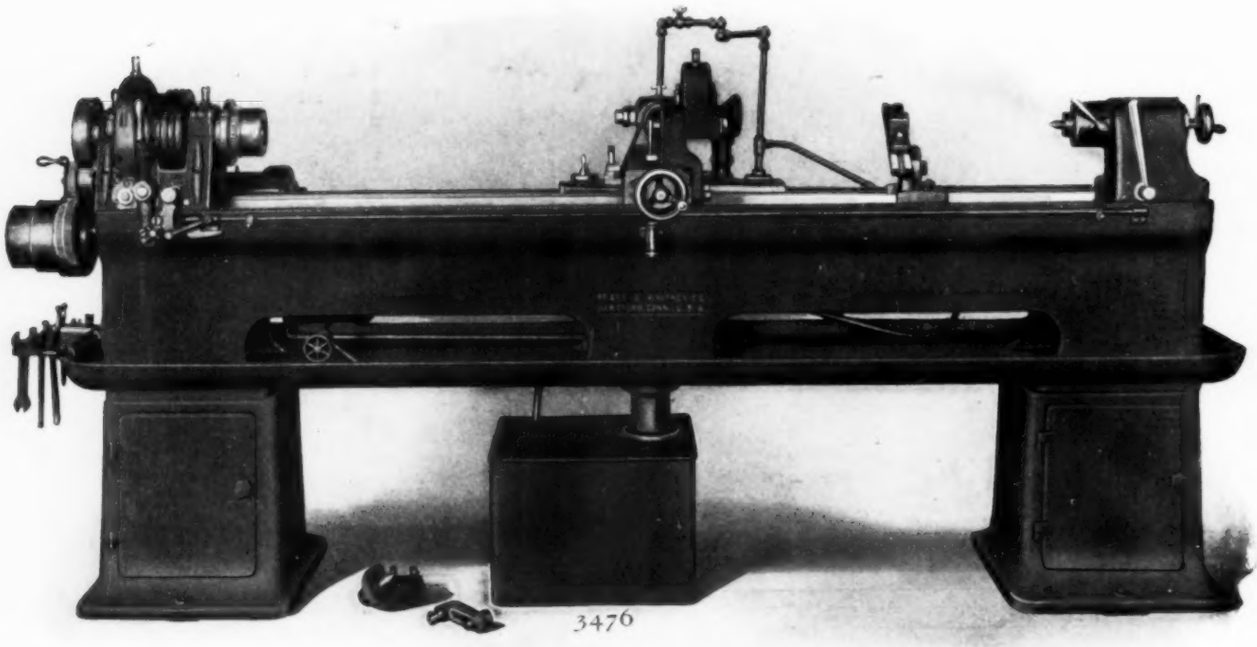

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Manufacturing the Monotype Keyboard

The Keyboard with Its System of Air Pipes and Operating Plungers Is Accurately Built by Means of Ingenious Jigs and Other Appliances

EDITORIAL CORRESPONDENCE

One of the well-known products of the Taft-Peirce Manufacturing Company, Woonsocket, R. I., is the Lanston Monotype keyboard, an illustration of which is presented in Fig. 1. In connection with the building of this ingenious piece of mechanism, some interesting appliances and methods have been developed at the Taft-Peirce works and a few of these are shown herewith.

Keyboard Construction

The Monotype keyboard carries 257 keys, 225 of which represent letters, figures and other characters, quads and spaces. Any one of these keys when depressed causes an air-controlled punch, or pair of punches, to perforate a strip of paper wound upon a reel at the rear of the keyboard. The perforations differ in combination and location for each letter or other character on the keys, and when the reel of paper is placed in the Monotype casting machine the matrix case in the latter is automatically operated over the mold to produce in type the characters represented by the perforations. The other keys on the board, not represented in the group of 225 just referred to, control the justifying punches and other mechanism.

The arrangement of the banks of keys on the keyboard is seen in Fig. 1. An interior view showing the under side of the keyboard base with the system of air pipes by means of which the perforating punches are pneumatically operated from the series of keys, is illustrated in Fig. 2. The base of the keyboard is shown in Fig. 3 with a number of the key-plunger bars in place, while other bars ready for mounting are shown at the front and side of the base. Each of these bars is adapted to carry 17 key plungers for controlling the supply of compressed air to the different pipes, and as each bar is provided with air passages and ports, the sides of the series of bars which are placed directly against one another have to be finished accurately to prevent air leakage.

Drilling Jigs

The jigs used for drilling the numerous holes in the keyboard base are illustrated in Fig. 4. The jig to the left in this engraving is employed for the drilling of the holes in the flat, upper face at the rear end of the base, and, as will be noticed, is provided with four adjusting screws at the sides which are graduated and thus form a means of locating the jig centrally on the work.

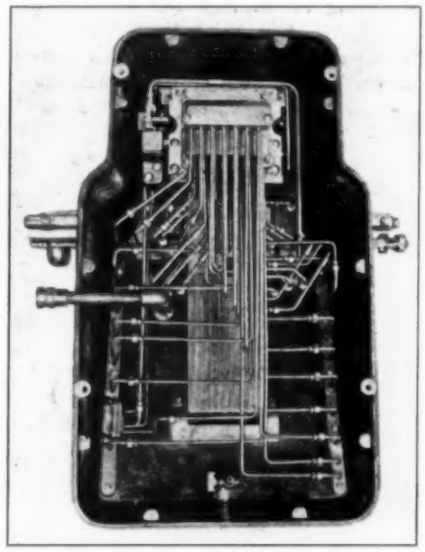


FIG. 2. ARRANGEMENT OF AIR PIPES IN KEYBOARD BASE

The jig in the center of the group in Fig. 4 is for drilling the necessary holes from the inside of the base. An inspection of Fig. 2 will show that there are a number of such holes required for attaching the piping and connecting apparatus. The jig at the right in Fig. 4 is for drilling the holes around the sloping surface of the keyboard to allow the key-plunger bars to be attached. The jigs are so constructed as to permit of locating from a common point, so that the holes must all come in the correct position relative to one another. During the drilling of the holes inside the base, the casting is held bottom side up in a suitable cradle.

An Indexing Jig

Another type of jig used to advantage is illustrated in Fig. 5. This device is constructed for drilling the series of holes in the bars which receive the key plungers. The work is clamped lightly to a slide mounted at the necessary angle in the jig base and provided with as many indexing notches as there are to be key-plunger holes in the bar. The locking pin is so situated as to stop the work at the

FIG. 1. THE LANSTON MONOTYPE KEYBOARD

right point, under the drill bushing, while each hole is drilled and, upon the completion of a hole, the pin is withdrawn by the lever, and the slide and work move along by gravity, the locking pin then dropping into the next notch and holding the work while the next hole is drilled. The operator becomes expert in manipulating the jig and the seventeen holes are drilled rapidly, the right distance apart and at the correct angle.

After the holes are drilled in the bars they are jig-reamed and then tobin-bronze bushes are pressed in place. These bushings are then reamed to size for the key plungers by means of a rose reamer in a bench lathe. The reamer has but a thousandth or so to remove, and the operator handles the work conveniently by resting his arm in a sling over the lathe bed and pressing the plunger bar directly against the reamer, which merely takes a scraping cut through each bush.

FIG. 4. JIGS FOR KEYBOARD BASE

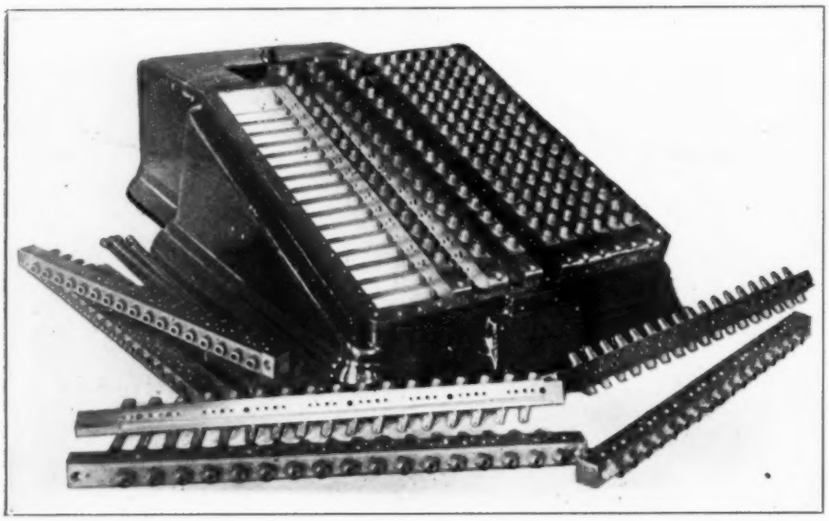


FIG. 3. KEYBOARD BASE WITH PLUNGER BARS PARTIALLY ASSEMBLED

Grinding and Fitting Operations

The key-plunger bars are finished on the sides by mounting them on a magnetic chuck and grinding on the surface grinder. The faces must be true and parallel. If any lack of parallelism should occur, the error, if multiplied through the series of fifteen bars, would produce a fan-shaped appearance, and if the faces abutting against one another were not perfectly true, leakage would occur along the metal-to-metal joint. In ordinary practice air is used in the keyboard under 10 to 15 pounds pressure, but in testing the keyboards at the factory a pressure of 35 pounds per square inch is employed.

The key plungers themselves, like the rectangular bars in which they fit, are provided with a central air passage and a number of ports, and in operation the keys are depressed clear to the shoulder to bring the matching ports in plunger and plunger bar opposite each other. The key plungers are of mild steel with a body about 3/16-inch diameter and a length of approximately 2¼ inches, the shoulder at the upper end occupying a length of practically 7/16 inch.

The straight body of the plunger is turned to size in a watchmaker's staff-lathe, the tool being very easily adjusted to cut the required depth and the lathe, when set in motion, taking the cut along the work and returning the tool to the starting point ready for the next piece to be inserted between the centers. So accurately are these plungers turned in this type of machine and so closely are the bronze bushings reamed to receive them, that very little hand-fitting is required to allow the plunger to work properly in its seat in the keyboard. Naturally, it is important that it work easily enough to respond to the light touch of the keyboard operator; at the same time it is absolutely essential that the fit be such as to permit no leakage of air at any point. Here is where the skill and judgment of the fitter are displayed. Taking a plunger which may work a trifle stiffly, with a suggestion of a brush with a fine file, he will ease it sufficiently at the right point

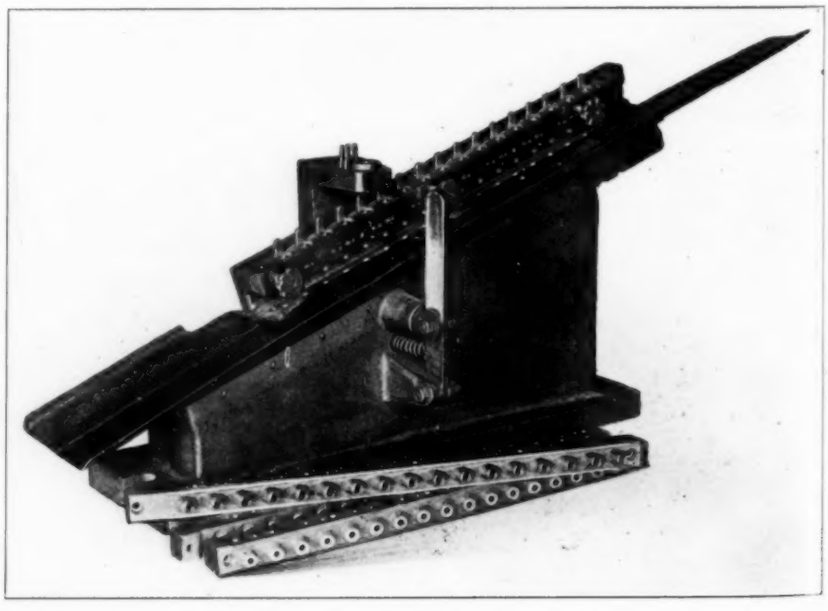


FIG. 5. AN INDEXING JIG

to permit it to be operated with perfect freedom, yet without leaking.

Accurate Drilling and Reaming

Some interesting examples of work finished nicely under the drill press are exhibited in Fig. 6. The two steel plates at the left when fastened together as seen to the right, form what is known as the punch lever block, as they receive the air-operated pistons controlled from the keyboard which operate the levers that in turn actuate the series of punches for perforating the strip of paper, as explained in the second paragraph of this article. The two steel blocks are about 1 inch thick and one has 16, the other 17, ¾-inch holes for the punch lever pistons, a number of which are shown in the foreground together with the short links by which they are attached to the punch levers. For each ¾-inch hole in the lower block there is also a smaller hole in the upper block to permit the passage of the link leading up from the piston in the lower block. The general arrangement will be obvious upon careful inspection of the illustration, and it will be seen

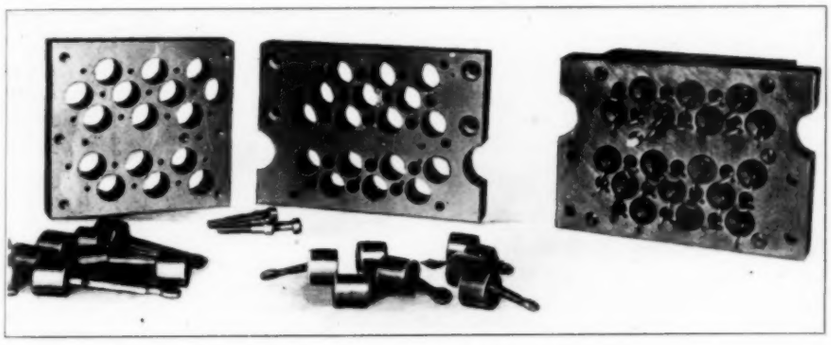


FIG. 6. PUNCH-LEVER BLOCKS

that the staggered arrangement of the two groups of pistons in the two blocks, one superimposed upon the other, permits the levers which they operate to be placed very closely together and at the same time does not bring any two holes in either block so close together as to render likely any distortion of the openings either during the manufacture of the blocks or the operation later in the machine.

The ¾-inch holes for the air pistons are accurately sized, are straight from end to end and have a beautiful mirror-like finish which it is impossible to reproduce in the half-tone illustration. These holes are finished in the drill press in the following manner: First the holes are drilled in a jig with a 23/32-inch twist drill, then a 4-flute spiral chucking reamer with a pilot to fit the drilled hole and a body 0.740 inch diameter is run through with an easy feed. This is followed by a similar tool having a pilot 0.740 inch diameter and a cutting body 0.748 diameter, thus leaving 0.002 inch to remove with an expansion reamer which finishes the hole to ¾ inch. This reamer is not piloted, but has at its leading end a ring which starts it centrally. A flood of lubrication is supplied to the tools and work and the results obtained are highly satisfactory. The limit of error allowed in the finishing of these holes is 0.0002 inch.

F. A. S.

Constant and Progressive Tolerances for Gages

By C. E. Johansson.*

In order to render possible the production of interchangeable parts, the deviations from the exact sizes, which, according to the special function of the pieces in a mechanism, are allowed on their principal dimensions, must be determined with the greatest possible care. The limits of these allowances are gaged by using such tools as snap-gages, thickness-gages, plug-gages, etc., each having one dimension for the larger size, called the maximum-gage, and one dimension for the smaller size, called the minimum-gage, of which when gaging an outside-size the maximum-gage (a snap gage) *must go*, and the minimum *must not go* over the piece, whereas for inside measuring the case is the reverse, i. e., the minimum-gage (a plug gage) *must go* and the maximum *must not go* into the piece.

The sizes of the pieces, consequently, are allowed to lie anywhere within the limits of tolerance determined, without thus losing their character of interchangeability, and in this way the difficulties encountered in manufacturing have been to a great extent eliminated and as a result it has become possible to push the manufacturing at the same time maintaining a good interchangeable product.

Importance of Gaging Systems

In consequence of these facts the gaging is now of much more importance than at the time when machined parts had to be subjected to adjustment with file, etc., before being assembled. Experience has proved that the principal condition of profitable large-scale-manufacturing not only is to be found in the extensive employment of the best machinery, but also that the saving of time is brought to a maximum only when the finished parts after reaching the erecting department can be assembled without slow adjustment. This is made possible only by using in the manufacture of the separate parts measuring tools of high perfection, excluding every possibility of error when taking measurements during the performance of the different operations. In this case it becomes, however, absolutely necessary that the measuring tools used be in true correspondence to each other, i. e., that they have an exact relation to a given measuring unit.

Constant Tolerance

To produce two pieces that are absolutely alike is an impossibility, because the diminutiveness of the difference between the two pieces may be extended infinitely. Still, within the bounds of practical possibilities, the accuracy can be made perfectly reliable and practically satisfactory even for standard gages and this is attained by arranging also the inevitable tolerance in a systematic way.

Up to the present time, it has been and it still remains a custom to give standard gages and measuring tools on the whole, irrespective of size, one and the same tolerance or degree of accuracy. The leading manufacturers of measuring tools have based their guarantee of accuracy on the system of an invariable limit of tolerance for all dimensions. Even the Standard Bureaus in the world, such as those in Paris, London, Washington, Berlin, adhere to the same system, maintaining for each different controlling standard tolerances of the same undeviating value. The standards of Paris for checking millimeter sizes are stated to be correct to within 0.001 mm. The standards of Physicalische Technische Reichsanstalt at Charlottenburg near Berlin, being checked by Bureau International des Poids et Measures in Paris, are supposed to be accurate at 0.001 mm. The leading Standard Bureau of Great Britain, the National Physical Laboratory, has received its standards from the French Artillery and has for the inch measure adopted a constant tolerance of 0.00005 inch for all sizes from 1 inch up to 36 inches, and so on. The National Bureau of Standards, Washington, D. C., has, however, for millimeter sizes recently ordered a set of the Swedish Combination Standard Gages illustrated in the American Machinist at pages 393 and 790, Vol. 30, part 2.

Drawbacks of the Present System

Anybody familiar with measuring instruments and standards will readily understand the drawbacks of a system of constant tolerance after having once had his attention directed to the disadvantages connected with its use.

*Originator and maker of the Swedish combination gages, illustrated at pages 393 and 790, Vol. 30, Part 2.

The standards for most countries are claimed to be accurate to a limit of 0.001 m/m. First and foremost, this is wrong from a manufacturing point of view, because the manufacture of a standard gage of say 10 millimeter size with a limit of tolerance of 0.001 millimeter is, by aid of a fairly reliable measuring machine, comparatively easy, whereas the finishing of an end-measuring block say 36 inches in length to the same degree of accuracy is connected with diifficulties a hundred times greater.

The difficulties in the first place will be found in the changeability of the steel, as this is effected by the variations in temperature, a circumstance which—especially with the larger sizes—has a fatal influence on the accuracy of the standards. The coefficient of expansion and contraction of steel being 0.0000106 (in this case for the sake of simplicity rounded off to 0.00001), a gage of 100 millimeters length expands about 0.001 millimeter for each rising degree centigrade, whereas a 10 millimeter gage changes only 0.0001 millimeter and a 1 millimeter gage 0.00001 millimeter. Taking a larger block, the expansion, consequently, is quite noticeable, the length for instance, of a 1-meter standard rod increasing 0.01 millimeter for each rising degree centigrade from which fact may be inferred that if the temperature of the 1 meter rod during the adjustment operation differs only 0.01 degree centigrade from that of the standard used for the purpose the whole tolerance granted, i. e., 0.001 millimeter is completely annihilated.

Other Difficulties

Outside of this, it can truthfully be said that an equally high degree of accuracy of the large and the small gages is more or less superfluous, as the weight of the tool itself most unfavorably influences the fine feeling which is essential in taking accurate measurements.

The impropriety of an invariable, and for all sizes of gages, equally small or great tolerance is, however, above all seriously felt—no matter if the end-measuring blocks form part of a combination measuring system or not—by reason of the fact that the small dimensions never to a full certainty can be calculated to form even fractions of the larger sizes. Thus, for example, the sum of a number of small sizes, the real values of which are approaching the upward tolerance (+) exceeds the real value of the measuring blocks, which lies within the tolerance admitted and corresponds with the normal sum of the small blocks, whereas, if the tolerances of the small blocks all are downward (—), the case is the reverse.

A Practical Illustration

Supposing a slot of say 6 inches width is to be formed in a working piece and a number of pieces, say 10 only, measuring in all 6 inches, are to be fitted in that slot. If the tolerance of the end-measuring blocks used for testing the slot as well as for checking the snap gages used for measuring the separate pieces is 0.00008 inch, the slot is measured to be 6 inches + 0.00008 inch and the total of the parts 6 inches + 10 x 0.00008 inch = 6 inches + 0.0008 inch, exceeding the width of the slot by at least 0.0007 inch, and the chances of their going in the slot are limited therefore to the cases where the tolerance of the measuring pieces used is equally proportioned or more often minus than plus.

As the object of a combination measuring system is the construction of larger sizes by means of small ones, and as one measure made up in that way naturally has to agree exactly with the single gage of the corresponding size, it is to be inferred from the above that a constant tolerance cannot under any circumstances be used in a combination measuring system. When undertaking to put up a combination measuring system it is, therefore, necessary to break with that practice and, as indicated above, arrange the unavoidable tolerance in a systematic way.

Progressive Tolerance

It has been demonstrated that in a measuring system, if it is built up for making combinations, the constant or invariable tolerance, hitherto solely in use, must be rejected. By giving, on the contrary, the different measuring pieces of a system a tolerance that corresponds to their size or, in other words, a uniformly increasing tolerance in the same proportion as the length of the measuring pieces increases, such a measuring system will prove satisfactory for accurate measurements and fills the condition for a reliable combination measuring system, which may be formulated as follows: *When making up any desired combination gage, it should be exact within the tolerance determined for that size, and this tolerance should correspond with the sum of the tolerances of each of the single gages embodied in the combination gage in question. This is called a progressive tolerance.*

A set of measuring gages constructed on that principle always gives correct values for every one of the multitude of combinations obtainable with it. Starting, say, from an end-measuring block of 4 inches length with a tolerance of 0.00004 inch the 2 inch gage in a combination gaging set with progressive tolerance is exact at 0.00002 inch, the 1-inch gage at 0.00001 inch, and so on.

The progressive tolerance may be made smaller or greater, finer or rougher according to the requirements and the accuracy of the work for which the gages are to be used.

Basis of the Swedish Combination Gage Set

The Swedish Universal Combination Gaging Set, intended for standard and accurate work, is based upon a coefficient of tolerance as nearly as possible corresponding with the coefficient of expansion and contraction of steel, viz., 0.00001 part of the length of the gage. The tolerance of a certain size can hereby easily be calculated and the value wanted without difficulty be kept in mind.

If, therefore, as in the present case, a 4-inch block is given a tolerance of 0.00004 inch, the 0.25-inch block has a tolerance of 0.0000025 inch, the 0.75-inch block 0.0000075 inch, the 1-inch block 0.00001 inch, the 2-inch 0.00002 inch, etc. If these gages 0.25, 0.75, 1 inch and 2 inches are assembled, making a combination gage of 4 inches, the summed up tolerance of the combined gages, viz., 0.0000025, 0.0000075, 0.00001 and 0.00002 inch, makes 0.00004 inch, equaling the tolerance of the 4-inch block.

By adopting the progressive tolerance when building up a combination gaging set, values of measure are obtained that in the single blocks as well as in the combinations are exact not only within the limits fixed by the leading bureaus for their standards, but, what is more, absolute values of measure are obtained on a uniformly rising scale within the progressive tolerance, the consequence of which is that when two or more already built-up combinations of certain sizes are assembled the larger combination thus obtained will also lie within the tolerance originally fixed for that size.

Tests for Accuracy

In order to prove the reliability of the values obtained by combinations tests may be made in a carefully adjusted snap gage with the single end-measuring block having the size of the snap gages, and immediately after with any combination of two or more blocks making together the same size as the single block. The fit being absolutely the same not the slightest difference in the feel will be perceived. If, for instance, the snap gage has a 1-inch opening, the 1-inch block out of the set is tested in it, and afterwards a combination of say 0.25, 0.175, 0.125, 0.350 and 0.100 inch or any other built up measure, making a total of 1 inch.

From a paper read before the American Society of Civil Engineers by Dr. J. A. L. Waddell, some interesting comparisons are drawn between the new nickel steel and carbon steel, particularly with reference to its adaptability for bridge-building purposes. As a result of extensive tests carried over a period of three years the conclusions arrived at by the investigator tend to show that a nickel steel with a percentage of nickel of from three and a half to four and a quarter would possess straining qualities 70 per cent. higher than carbon steel, and that there would be a saving in the cost of bridge construction by its use.

Some Machine Tools Built in English Shops

Milling Machines, Turret Lathes, Worm Wheel Hobbers, Thread Millers and Hob Grinders Are a Few of the Tools of Recent Design

BY JOSEPH G. HORNER

The accompanying engravings illustrate a few of the English machine tools shown by various builders at the Franco-British exposition, at Shepherd's Bush, London.

Universal Milling Machine

The first tool here illustrated is a universal milling machine built by John Hetherington & Sons, Ltd., Manchester.

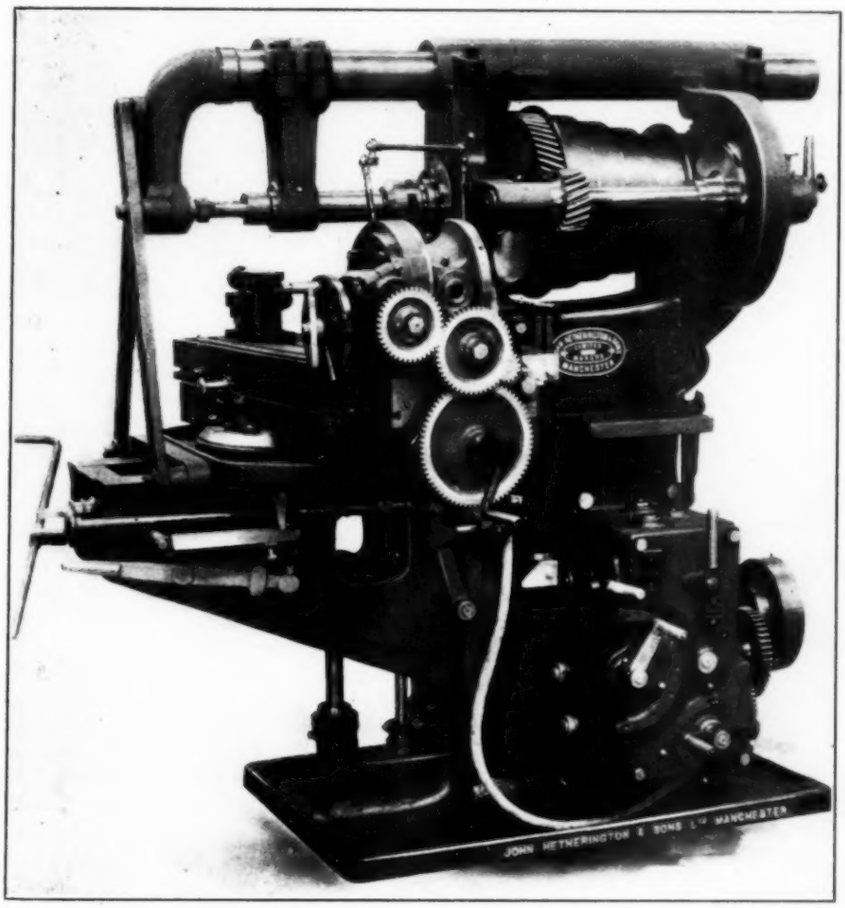


FIG. 1. UNIVERSAL MILLING MACHINE

In this machine, seen in Fig. 1, will be noticed the use of helical teeth in the back gears, a feature which is common to many machines of Continental build, but is not often seen in England. The large diameter of the smaller steps may be noticed, giving plenty of power. There are two sets of back gears, single and double, respectively, which, with a two-speed countershaft, give 24 spindle speeds, ranging from 29.2 revolutions to 788 revolutions per minute, and in geometrical progression. The feed gears are inclosed in the box on the side of the pillar. Of the three levers seen at the front of the box, one puts in the various feeds which range from ¼ inch to 6 inches per minute, eight feeds being available for each of the 24 spindle speeds. Another lever reverses any feed, the same rate being maintained in both directions. A third reverses at a rapid rate for return non-cutting strokes. These are available alike for the longitudinal, transverse, and vertical movements of the several slides. There are also two knock-out or trip dogs, which, being set to any position desired, are struck by a horizontal sliding pin on the knee slide, and which in turn knocks out a clutch and stops the feed.

Vertical-spindle Milling Machine

Fig. 2 shows a Hetherington vertical-spindle milling and drilling machine driven by a 12-horsepower motor. The spindle drive is through two sets of gears, either of which is thrown in by the clutch seen between the two on the spindle. Sixteen spindle speeds are available, ranging in geometrical progression. The spindle feeds used for drilling with the spindle as when preparing work for cutting out recesses, are transmitted from the gear box on the side of the column through the pair of narrow gear wheels seen on top of the upper set of driving wheels. These are operated from worm and spur gears, and power is transmitted thence to a rack and pinion. Three rates of down feed are imparted thus to the lower bearing of the spindle. The slide is also provided with hand adjustments. The table feeds which are derived from the box of gears on the side of the column give a series of eight feeds to the tables, including the circular table. Hand movements are provided for the slides, an adjustable stay is fitted to the lower end of the cutter arbor, and there is a profiling attachment. A rotary pump provides for lubrication.

Vertical Boring and Turning Mill

The vertical turning and boring mill in Fig. 3 by the same company takes up to 5 feet diameter, and weighs about nine tons. The spindle, of cast iron, measures 11½ inches diameter, and the length of its top bearing, also in cast iron, is 20½ inches. It is coned, and has provision for taking up wear. The table runs on a flat annular face on the bed, which is lubricated by two rollers in oil wells, similar to those employed in the ways of planing machines. The table may be lifted off the annular face when boring and turning of small diameters, or polishing has to be done, when the spindle runs on a short-coned face.

The same design of speed change and feed gears are used as in the other machines by this firm. An 18-horsepower Westinghouse motor is mounted on the speed-change gear box, the latter containing double, triple and quadruple gears, by which, with the handwheel and lever in front 24 changes of table speeds are available, arranged in geometrical progression. The feeds are put in by the handwheel adjacent to the near upright, by which a variation of eight feed changes, ranging from 1/32 to ⅜ inch can be got for each of the 24 different table speeds. These are available for the horizontal, and vertical, and angular movements of the saddles and tool bars, and while the machine is in motion.

The saddles have tool rams of octagonal section, balanced, and with provision for angular settings by worm and quadrant rack. The rams have steel tool holders at their lower ends for tak-

ing two tools for boring, turning, or surfacing. Each has a rapid vertical hand adjustment by handwheel, pinion, and rack. Horizontal fine adjustments can be effected through the traversing screw and worm shaft from either end of the cross-rail. The whole cross-slide and its tool holders are elevated and lowered by power. A small pulley at the end of the motor shaft is belted to a pulley above. This drives through reversing bevel gears adjacent, with a sliding clutch moved by a chain, thus actuating spur and worm gears, and thence the elevating screws in the housings.

Worm-wheel Hobbing Machines

In Fig. 4 is illustrated a worm-wheel hobber, built by John Holroyd & Co., Ltd., Milnrow, near Manchester. This machine cuts worm wheels only, which is conducive to simplicity of design and rigidity of construction. The wheel blank is mounted on a rotating table, which latter is carried on a slide along the bed to which it is gibbed. The slide carries a cast-iron sleeve which is screwed into the table. This receives a steel spindle which is bored out to a Morse taper, to take the work arbor. This is rotated at the speeds required by means of change gears which are connected to a worm and worm wheel. The spindle can be adjusted vertically in order to bring the center of the wheel blank in line with the center of the hob.

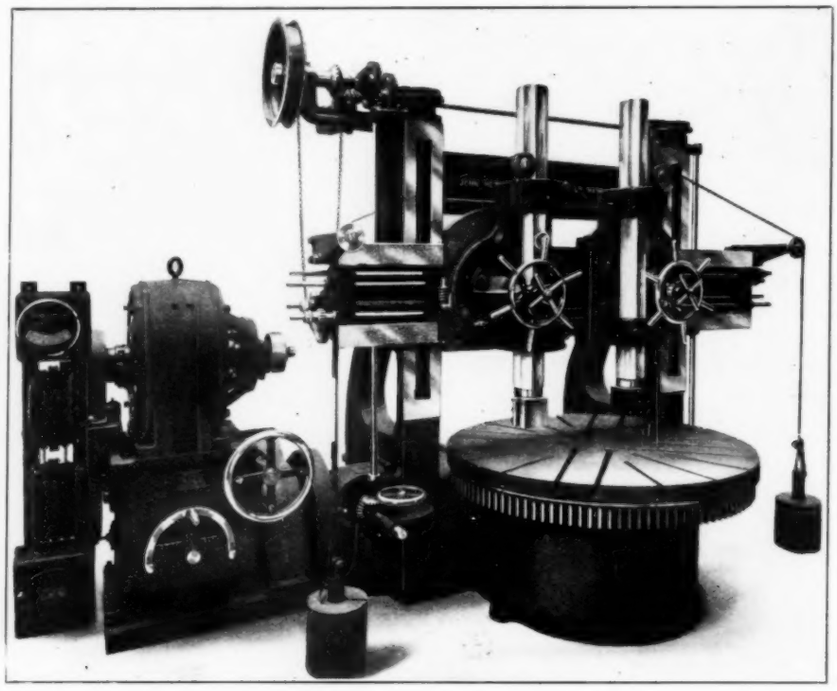


FIG. 3. VERTICAL BORING AND TURNING MILL

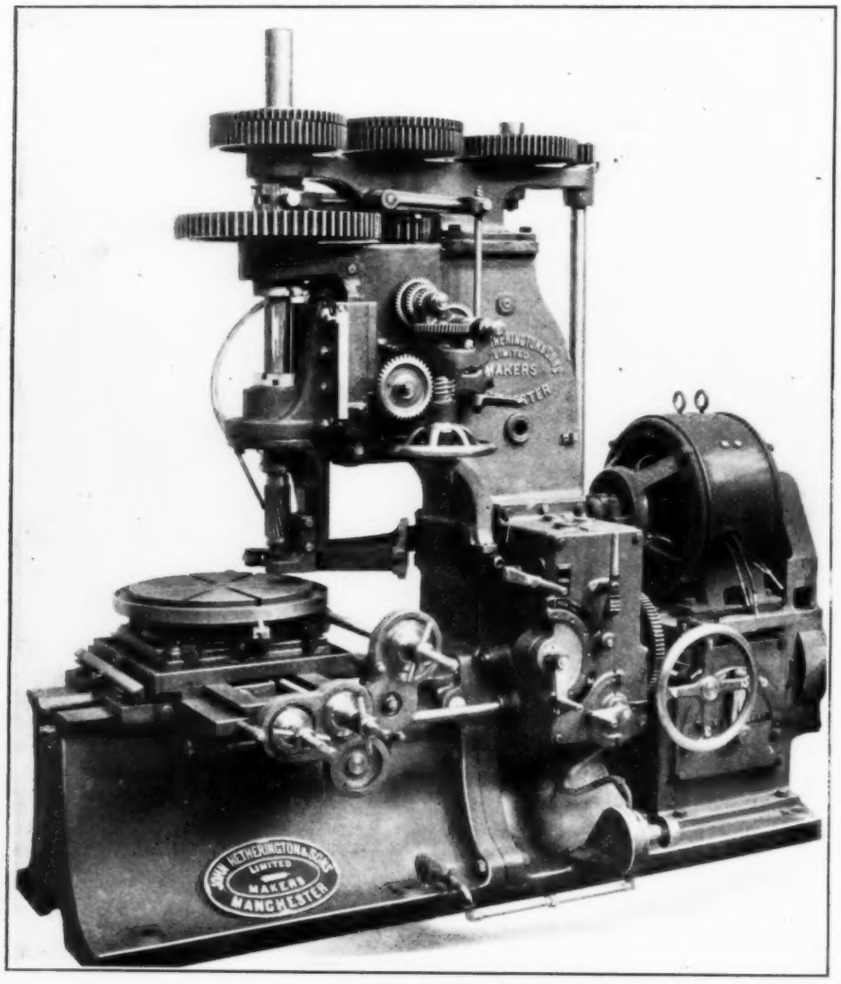


FIG. 2. VERTICAL MILLING AND DRILLING MACHINE

The hob is carried horizontally on an arbor fitting with a Morse taper into a spindle which runs in cone bearings, and is driven from a stepped cone pulley. This has three steps, so giving six speed changes to the hob. The outer end of the arbor is supported in a hardened-steel bush.

When a wheel is being cut with a tapered hob sliding tangentially, a special rotative motion must be imparted to the blank to compensate for the sliding of the hob. This is obtained from differential gears which are connected to the feed screw of the hob slide by means of change gears. By this device the speed of rotation of the blank is constantly altering to suit the travel of the hob. The feed of the hob slide is derived from the differential gear box, which drives through miter gears, and through a drop-out worm and a wheel which is connected to the feed screw by spur gears. A self-acting knock-out is fitted, by which the hob slide is thrown out of action by means of an adjustable collar which releases the drop-worm box.

Parallel hobs can be used in these machines. In this case the blank and hob are set centrally, and the hob slide is locked. The blank is then fed automatically into the rotating hob by means of a cam fitted on a disk. This at every revolution actuates a rocking lever connected to a ratchet and pawl mechanism mounted on the feed screw, and the cutting proceeds until the proper depth of tooth is completed.

Automatic Hob Grinder

Another machine by John Holroyd & Co., Ltd., is illustrated in Fig. 5. It is designed primarily for the automatic grinding of hobs, and is, therefore, a result of the large demand for hobs which has been created by the growth of the recent gear-hobbing machines. It can be used also for grinding spiral reamers, and milling cutters, whether straight or spiral.

The machine is carried on a box base, at the back of which is the grinding-wheel head, and on top of which the mechanism for carrying and actuating the hob is mounted. This mechanism includes two main portions, a fixed head seen to the left, and a table to the right, with heads by which the hob is carried and operated and a spindle on which it is fitted. This spindle (which is 2 inches diameter) enters into and slides through a sleeve which goes through the fixed head. The sleeve is the driving agent, receiving its rotation through bevel gears from a three-speed cone, which also drives to the screw by which the movable table is traversed. The extreme end of this screw is seen projecting at the right-hand end of the bed. A differential gear is mounted on the center of the sleeve, the center block of which rotates it, and on each side is a worm wheel, one of which revolves the sleeve and spindle slowly to suit the spiral being ground, and the

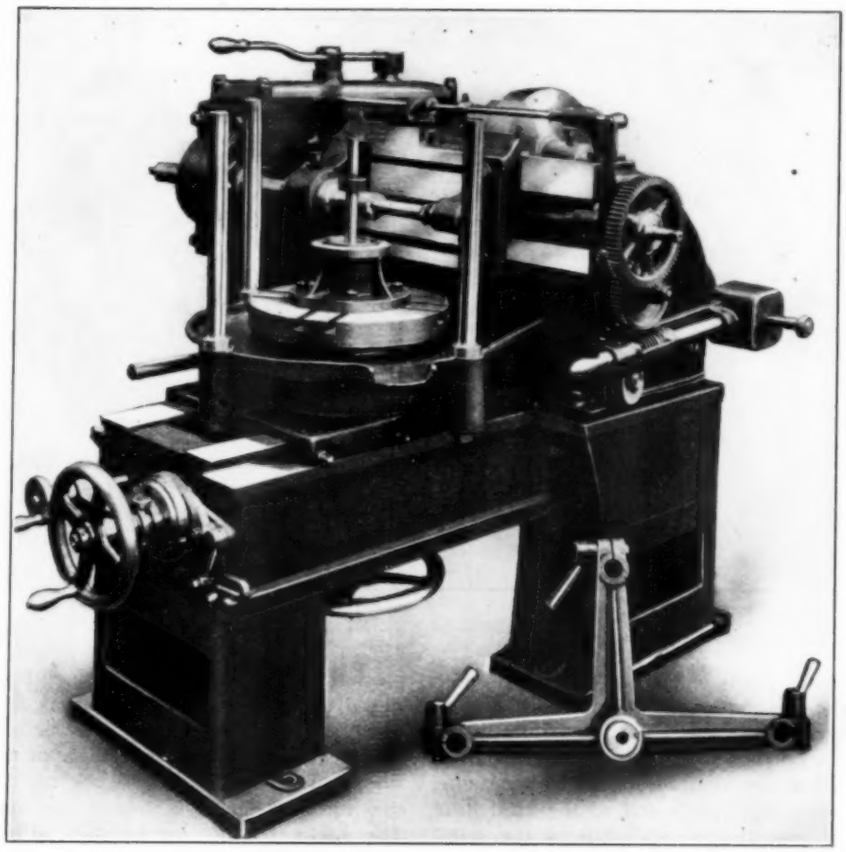


FIG. 4. WORM-WHEEL HOBBING MACHINE

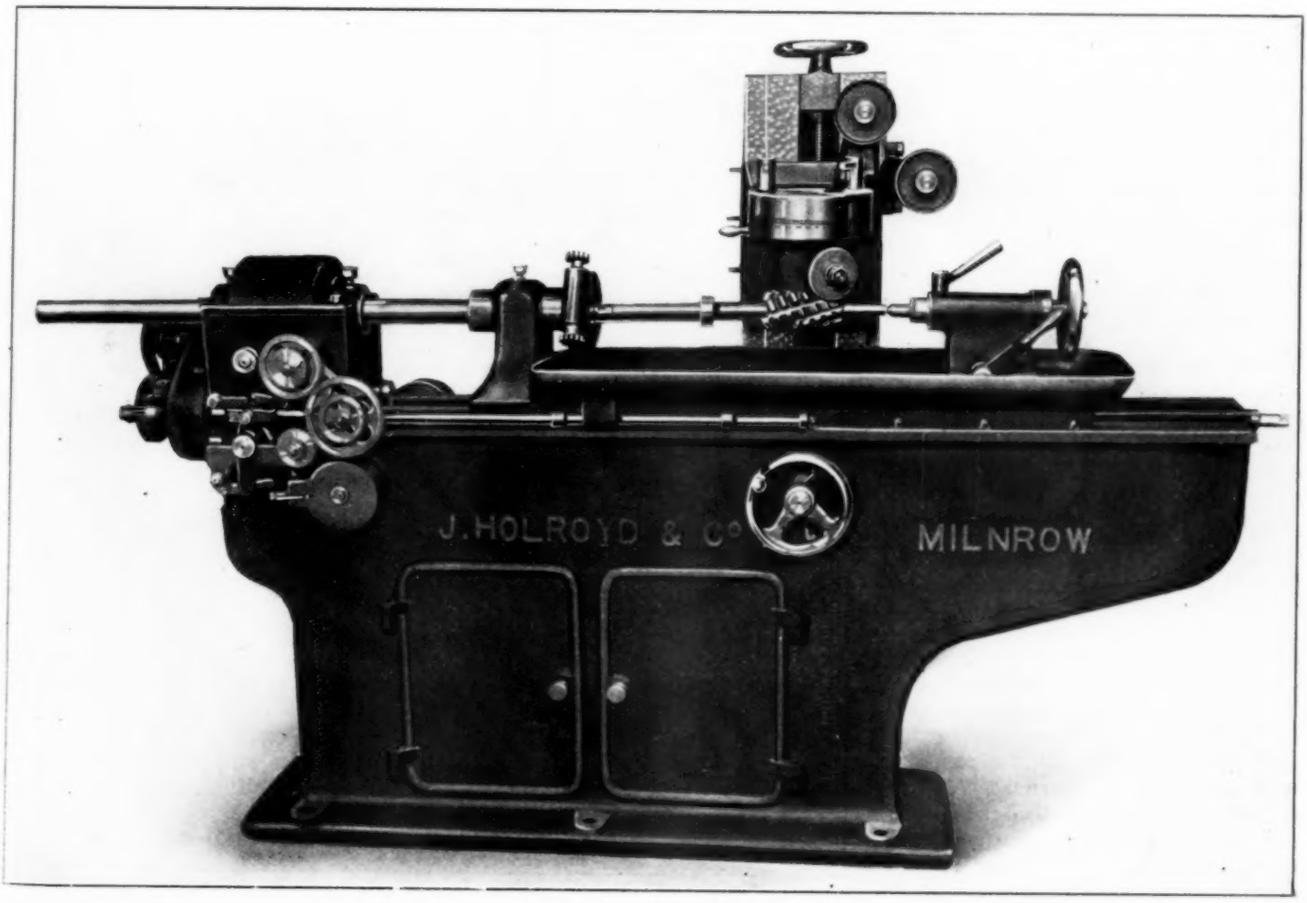


FIG. 5. HOB-GRINDING MACHINE

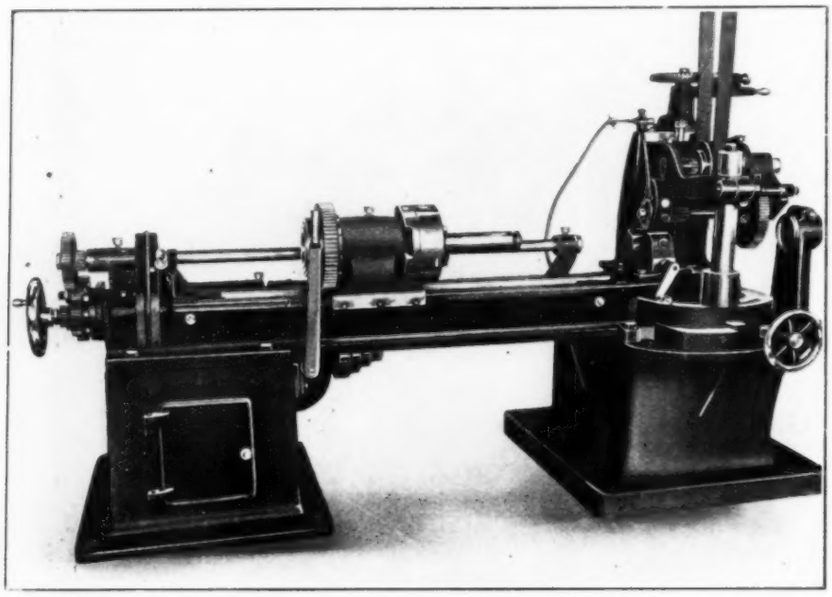


FIG. 6. THREAD-MILLING MACHINE

other rapidly at the end of a cut to effect the division or pitching for each gash or flute in the hob. The special feature of this drive is that the spindle and the screw are geared together by change gears at the rear end of the fixed head, to give the correct pitch of the spiral. Within the gear box at the end of the head there are three gears, one on the shaft which rotates the spindle, one on the screw, and one situated centrally on the driving shaft, which can be slid so that it may engage with either of the other two. The drive to the change gears may be always toward the end where the smallest wheel is. The change gears for giving the pitch of spiral are arranged with the same number of teeth as those used on the universal miller on which the hobs would be gashed. A reversing motion for the slide is fitted, comprising a stop rod and a spring catch connected to bevel gears.

How the Work is Indexed on the Grinder

The method by which divisions are effected automatically is as follows: A belt runs on a loose pulley, and is held by a belt fork so that it has enough frictional contact with a fast pulley adjacent to drive the latter immediately the coercion of a stop catch is removed. The catch is located at the front of the machine just below the fixed head, and is operated by the same lever which actuates the reversing clutch just named. There is a set of change gears at the front of the headstock which are arranged so that one revolution of the stop-catch disk divides the hob correctly. Also, the driver plate seen on the end of the spindle is fitted with a worm and wheel, and small star wheel, in order to cause the hob to turn forward very slightly for putting on the cut once in every complete revolution. When the machine thus rigged up is started, the hob moves forward and revolves under the grinding wheel until the hob runs just clear of the wheel. The stop is then struck on the stop rod, and the movement is reversed. The backward movement, when at its termination, withdraws the dividing stop catch, and the hob rotates to the next flute. When one revolution of the hob has been completed the star wheel on the driver plate is moved by a distance equal to one tooth, so feeding the hob slightly forward.

The grinding-wheel spindle is carried in a head arranged to swivel to any angle, graduated in degrees, and having handles for swiveling and locking. The head is carried on slides with vertical and cross adjustments. The belt is tightened by adjusting pulleys. Wheels from 2 inches up to 6 inches may be used, and hobs to 12 inches diameter, and 18 inches long can be ground.

Thread-milling Machine

A Holroyd machine designed expressly for milling worms and screws is illustrated in Fig. 6. The cutter head is strongly built and arranged to drive the cutter through equal gears at the front end, or by means of a large gear at the back end of the cutter spindle when operated on heavy work. The cutter spindle is hardened and runs in a hardened-steel taper bearing with adjustment for wear. The swivel head is set to the correct angle by means of graduations at the back. The depth of cut is obtained by the handwheel at the top of the head, and a quick withdrawal of the cutter may be

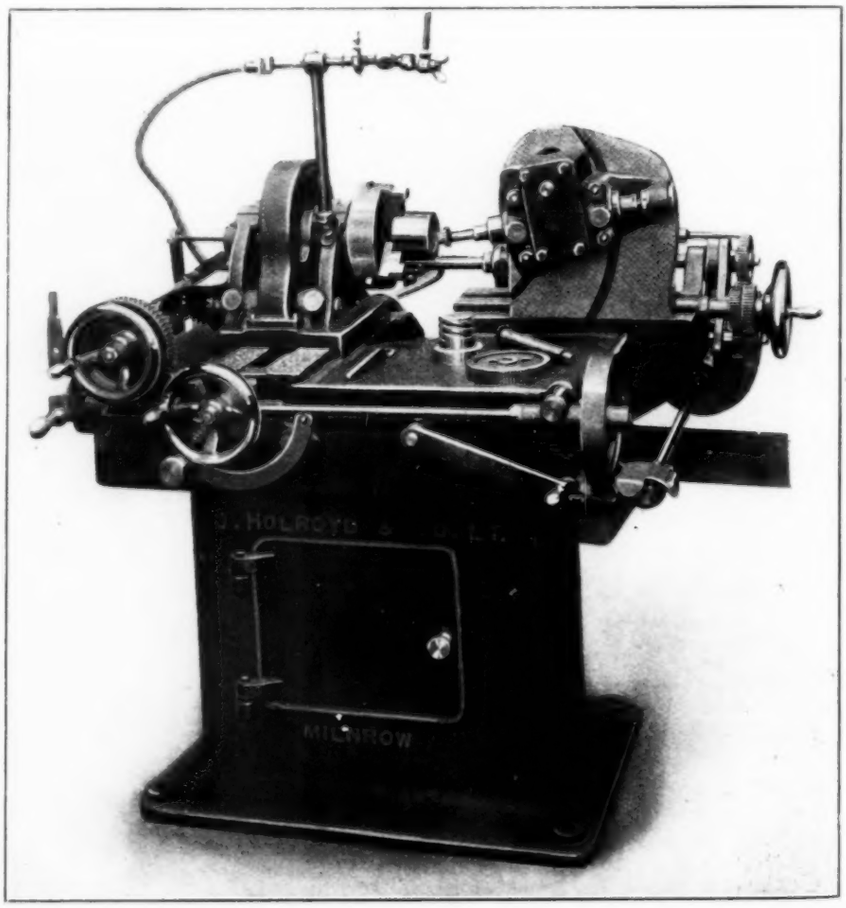


FIG. 7. SMALL MILLING MACHINE

obtained by the lever just below the handwheel. The carriage is gibbed to the bed and fed by a central lead screw with an adjustable nut for taking up backlash. The spindle has a 3½-inch hole for the passing through of long work, and is revolved by spur gears from a back shaft which connects by change gears to the lead screw. It is driven by a four-step cone and there are two changes of gears, a slow forward feed by worm and worm wheel with a quick return by spur gears. This feed is connected either to the back shaft, or to the lead screw by means of the swing plate shown at the upper end of the bed. The long vertical handle throws in the feed or quick return. The machine will cut screws 30 inches long at one setting, or any length by several settings. It will cut worms 3½ inches diameter by 14 inches long with the heavier gear in the cutter head.

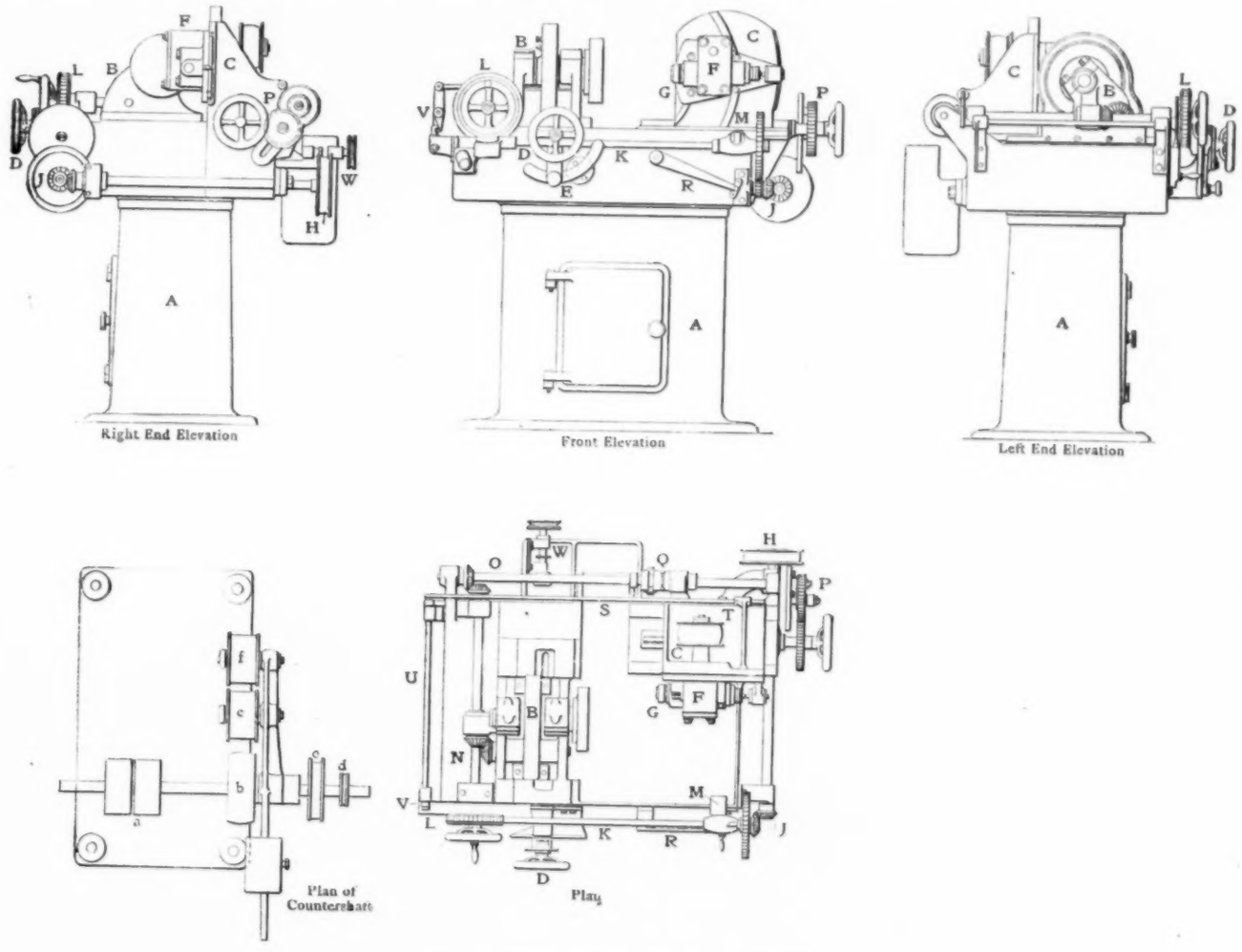


FIG. 8. SMALL SCREW MILLING MACHINE

Small Screw Milling Machine

A small screw milling machine built by John Holroyd & Co., Ltd., is shown in Figs. 7 and 8. It is adapted especially for cutting short internal and external screws, especially for clutch nuts, etc. Nuts up to 4½ inches internal diameter by 2 inches long can be milled; the largest external diameter cut is 4½ inches and length 3 inches. A cutter 1¼ inches diameter is employed for internal cutting.

The general appearance of the machine may be gathered from an inspection of the half-tone Fig. 7, while the drawing, Fig. 8, gives details of the construction. The bed *A* supports the work head *B*, and the cutter head *C*. *B* slides across to impart the necessary depth of cut, and *C* to provide the feed when milling. The method by which these motions are obtained is as follows:

There is a handwheel *D*, fitted with a micrometer dial, and turning a screw which moves *B* to and fro to any required position; a quick-withdraw motion, operated by turning the handle *E*, serves to run the slide back rapidly, when doing repetition work. The work spindle in head *B* runs in parallel gun-metal bearings, and has a three-jawed chuck on the nose. The cutter slide *C* has a spindle head *F* on its face, this being swiveled to the required angle, and clamped by bolts in the radial slots. The drive to the spindle *G* is by a belt pulley, 4½ inches diameter, through spiral gearing to *G*, which runs at 89 revolutions per minute. A No. 3 Morse taper hole in the nose receives the mandrels, which are also threaded at the ends to match the bottom of the spindle hole.

The Driving Mechanism

The drives for feed, and rotation of the cutter head and the work spindle respectively are derived primarily from a belt pulley *H* at the rear, turning a shaft which drives miter gears *J*, actuating a pair of spur gears adjacent, and rotating a shaft *K*, which has a worm near its end, turning a worm wheel *L*. This worm, with its box, is pivoted to drop out of engagement, the pivotal point being situated at *M*. Tracing the drive from the worm wheel *L*, we see that a cross shaft carries a sliding miter gear *N*, revolving inside a bearing forming part of the head *B*, so that the gear is carried along the splined shaft to any position which the head may occupy. This miter gear drives a companion, which turns a short shaft on which is a pinion, driving a spur wheel mounted on the work spindle. On the other end of the shaft carrying worm wheel *L* there is another miter gear turning a similar gear, by which a shaft *O*

is rotated, and this drives a short section of shaft further along and actuates change gears at *P*, which are coupled up by a swing plate to turn the feed screw of the head *C*, the gears being selected to give the proper ratio for the thread to be milled. The gears *P* are put out of action at will by moving a claw clutch at *Q*, through the handle *R* at the front. On putting a piece of work, therefore, in the chuck, and starting the feed of the cutter the thread is milled; in order to stop the machine the instant the length is reached, there is a stop rod *S*, which carries an adjustable collar *T*, struck by a projecting bracket on the back of head *C*. Rod *S* rocks a lever on shaft *U*, and releases the hooked catch *V*, which allows the worm engaging with worm wheel *L* to drop, so stopping both the revolution of the work spindle and the feed of the cutter slide simultaneously.

There is a small pump at *W* for flooding the cutter and work, the supply pipes being visible in the halftone. The plan of the countershaft shows the fast and loose pulleys *a*, belted from the line shaft, the pulley *b*, which drives the pulley for the cutter spindle, and *c* and *d* for the pulley *H*, and that of the pump *W* respectively. It will be seen that there are jockey pulleys *e* and *f* on a pivoted and counterweighted arm movable around *b*, the object of this device being to automatically take up the slack of the belt according to the position which the belt pulley for the cutter spindle occupies. The countershaft runs at 300 revolutions per minute.

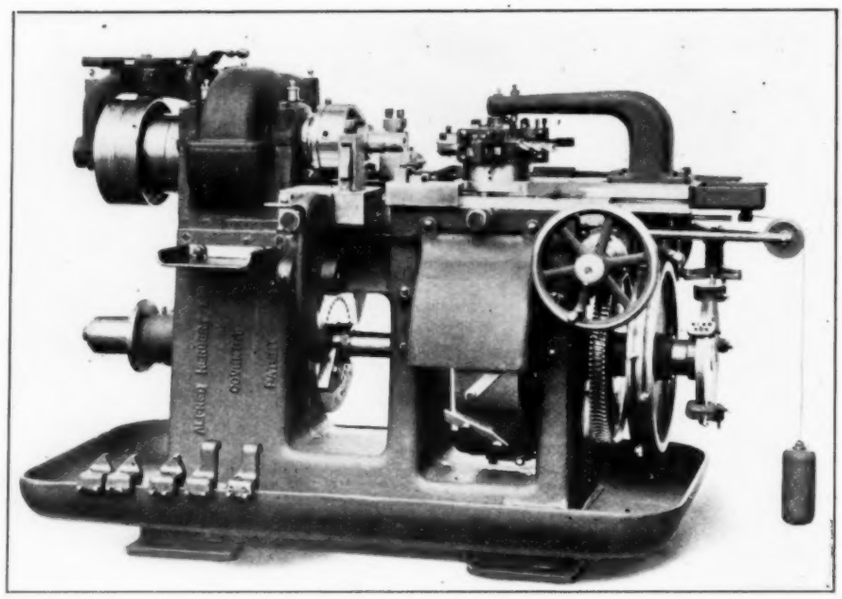


FIG. 10. AUTOMATIC TURRET MACHINE

A Heavy Turret Lathe

Some turret lathes built by Alfred Herbert, Ltd., of Coventry, are shown in Figs. 9, 10 and 11. The largest, Fig. 9, is a combination turret lathe, for bar and chuck work, and weighing 11,000 pounds. It is capable of taking a 5⅝-inch bar through the hollow spindle, and is equipped also with a common chuck weighing about 540 pounds fitted with various styles of jaws, besides special chucks capable of doing work up to 23 inches swing over the bed, and 15 inches over the cross slide. It is a most complete tool, comprising a friction-geared headstock, a hexagon turret 18¼ inches across, a square turret on the cross slide, and a chasing saddle for use with hobs. Seven horsepower is required for driving. The cone pulley has two broad steps for a 6½-inch belt, and nine speed changes are obtained for each step by movements of the levers in front of the head, which is of advantage when turning and boring large and small sizes on one piece. The eighteen spindle speeds range from 8.2 to 200 revolutions per minute. The axis of the turret is inclined, to permit tools which project out to a long distance to clear the handles of the pilot wheel in front, by which the turret saddle is moved by hand. The turret is pierced by six 3½-inch holes to allow bars to pass through. It receives 18 automatic feeds, coarse and fine, tripped by six independent adjustable stops, any one of which is only operative when its particular tool is in action. The cross slide which carries the square turret has longitudinal

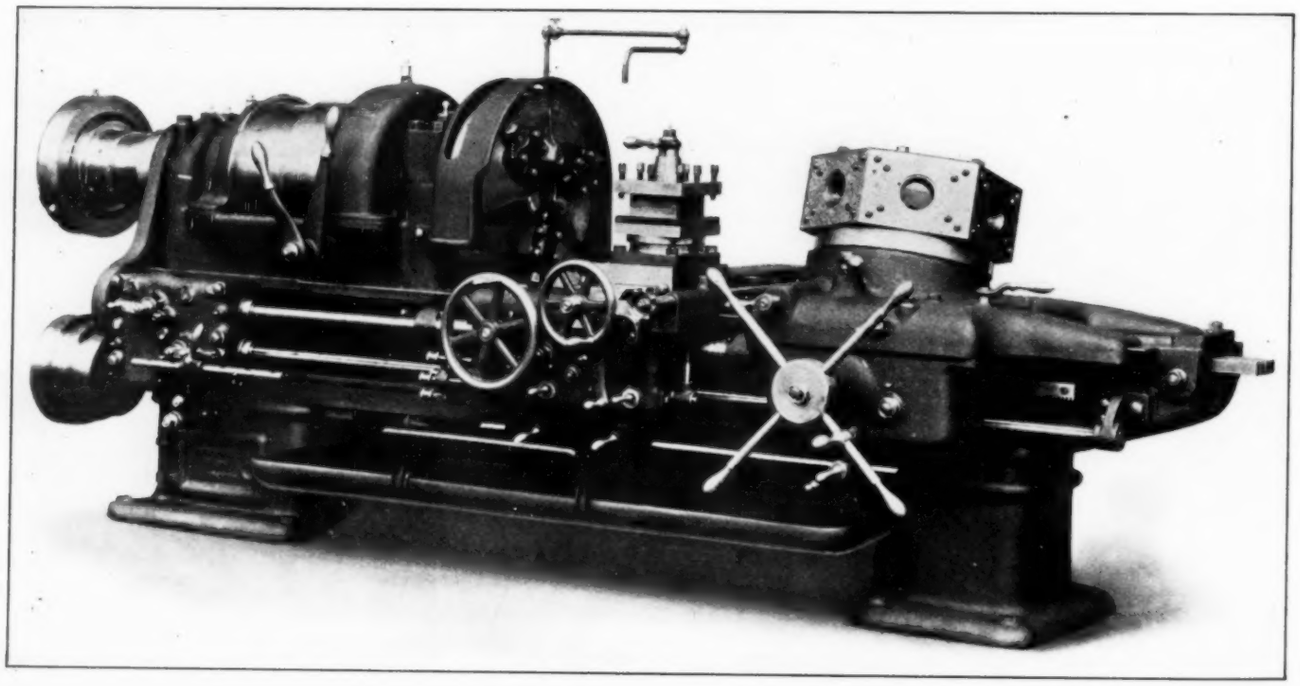


FIG. 9. LARGE HEXAGON TURRET LATHE

and cross feeds, both reversible, with 9 changes. The slide is mounted on the chasing saddle which is operated by a leader or hob, independent of the automatic feeds. Four pitches can be cut by each leader, by changing the speed of the latter. There is an arrangement whereby the act of putting in the nut to the hob also runs the tool up to position, and *vice versa*, without interfering with the usual hand-wheel feed, employed for setting the depth of cut. Turning and chasing can be done on the same piece, the change being made instantly, but without any risk of both being in gear simultaneously.

boring and turning small and large diameters. A double countershaft is used for driving these. Sixteen spindle speeds in all are available.

A pentagonal turret is used, and its backward thrust during heavy cutting is taken by an arched bracket bolted to the table and connected to the turret by a central pin. This is one of the comparatively recent additions since the introduction of the high-speed steels, by which the output of the machines have been increased. To avoid changing the operating cams on the drum beneath the turret, for various classes of work, a new device termed the "self-selecting" feed is introduced, so that a standard set of cams serves for all classes of work. There is an extra disk fitted at the extreme right-hand end of the cam shaft, and this carries as many dogs as there are cams on the drum. Each dog has seven holes arranged in two rows, parallel with the axis of the shaft, and a striking pin is screwed into either one of these. The pins set in the successive dogs strike a curved lever at various portions of its length (according to the lateral position of each pin) and the lever actuates a sliding key working inside the bosses of a set of spur gears, giving seven corresponding changes to the feeds of the turret slide for any one operation. These cutting feeds alone are affected, since the constant-rate quick return non-cutting movements are produced by another set of mechanism, as in the automatics of ordinary type.

The whole of the movements are automatic, so that the duty of the machine attendant is restricted to taking out and putting in pieces and starting the machine again. From four to six of these machines can be looked after by one man, as the length of time occupied in machining a piece is usually long enough to give him ample time to see to one after another. It may be mentioned that the fast and slow speeds of the spindle are thrown in and out automatically by the mechanism, according to the particular operation which is going on.

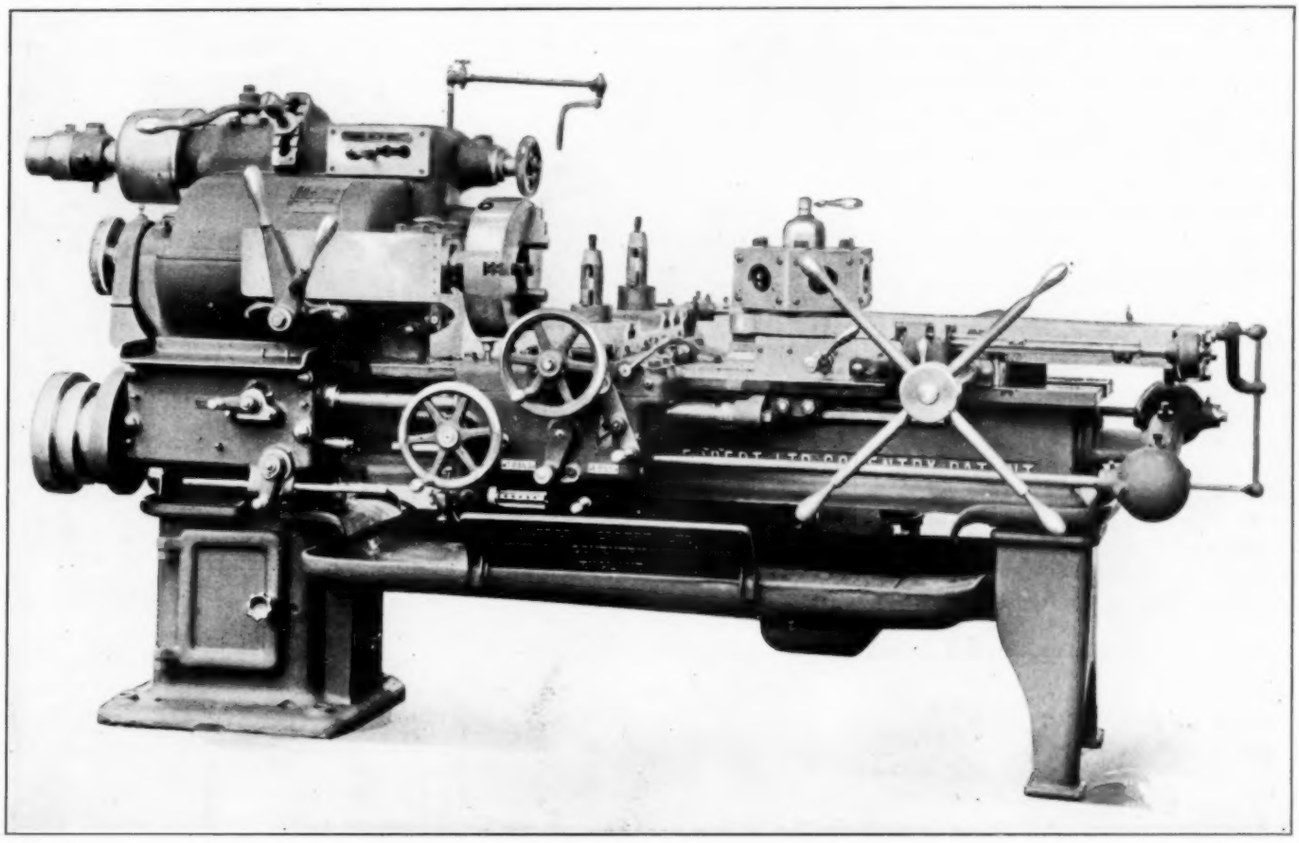


FIG. 11. HEXAGON TURRET LATHE WITH SINGLE PULLEY DRIVE

Automatic Turret Machine

In Fig. 10 is represented an automatic turret lathe built by Alfred Herbert, Ltd. This machine is an adaptation of the firm's regular automatic screw machine and is constructed for chuck work only. For the hollow spindle with wire feed, operated automatically, a jaw chuck is substituted with such modifications as the difference in the nature of the work demands. At first sight the machine presents the general appearance of the familiar automatic screw machine, having an identical cam shaft, cam drums, and disks, cross slide and turret. The principal differences are these:

The spindle is driven through spur gears by two sets of pulleys, each set comprising a fast and loose pair to give two sets of speed changes, rapid and slow for

Hexagon Turret Lathe with Single-pulley Drive

Still another Herbert turret lathe is shown in Fig. 11. This machine has a geared head driven by a single pulley giving 16 speeds in either direction, which are obtained by friction clutches in conjunction with a speed variator, with gears running in oil. A chasing saddle is provided which is operated by a leader that is changed to suit different pitches. Each leader will cut pitches which are multiples of its own thread in the ratios of 1, 2, 3, and 4, by means of the feed box at the head end of the lathe. There is also a reverse in this box whereby left- as well as right-hand threads can be cut. The nut is connected with the tool slide so that when it is thrown out the chasing

tool is simultaneously withdrawn from the cut, and *vice versa*, the additional depth of each cut being obtained by the cross-feed screw. There are four adjustable stops for both the longitudinal and cross-feeds. The turret is hexagonal, revolves automatically and has power feeds with six changes. The locking mechanism is of steel hardened and ground and provided with adjustment for wear. This machine will take 2-inch bars through the spindle.

LATHE WITH CONSTANT-SPEED DRIVE

A lathe of 9-inch centers (18-inch swing), built by the Colchester Lathe Company, of Hythe, Colchester, is shown in Fig. 12. The drive is at constant speed by a fast pulley, belted from the lineshaft, with loose pulley adjacent. The drive is at 400 revolutions per minute; or motor can be coupled directly to the pulley spindle. Thence 18 spindle speeds are obtained through changes in the headstock gears effected by moving two levers in front and one above. There are 13 gears in the box, made from steel forgings, but only those actually doing work are in engagement. The speeds range from 9 to 360 revolutions per minute, nearly in geometrical progression.

The lead screw and feed rod are driven through the gear box below the headstock. Thirty-two pitches, and 32 feeds are available thus. The first range from 2 to 30 threads per inch, the turning feeds from 0.125 to 0.008 inch per revolution of work. Other threads can be cut out by altering the change wheels on the swing plate, as in ordinary lathes.

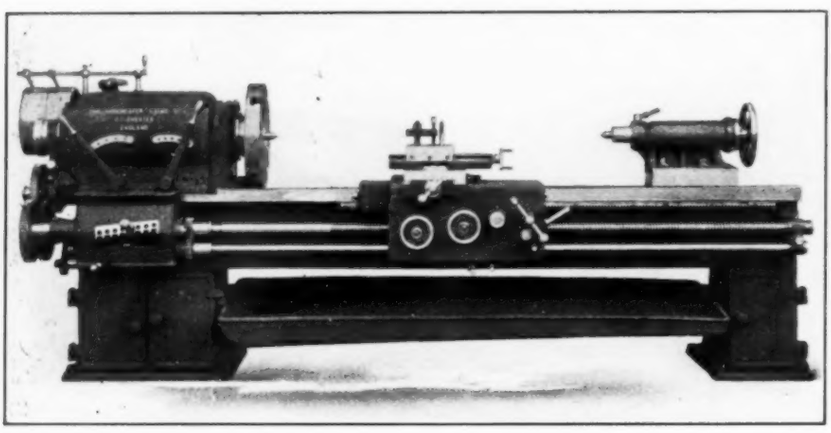


FIG. 12. LATHE WITH CONSTANT SPEED DRIVE

Sliding and surfacing motions are thrown in and out by clutches. The gears in the apron are supported by double bearings. Cabinet legs, and a waste lubricant tray are conveniences that will be noted. The carriage has a length of bearing of 30 inches on the bed, and it is guided by a narrow raised strip at the front, to which the gib is fitted. The bed is 10 feet long, 16½ inches wide, and 12½ inches deep, and the lathe weighs three tons.

A German Indicator

BY W. POCKRADT

This sensitive indicator for accurate measurements is shown in position for testing the spindle bore of a lathe in Fig. 1. It serves not only to test the concentricity of the bore of the spindle to hundredths of a millimeter, but also the parallelism of this bore with the ways of the lathe. Indications or measurement may be either plus or minus, and for that purpose the zero point is at the middle of the graduated scale in the larger end of the instrument. This indicator is contained in a sector-shaped case, having on its back a lug that serves to clamp it in any desired position by means of a suitable holder and winged nut. The pointer receives its motion from the button, shown at the small end of the indicator, through a system of multiplying levers. The pointer can traverse the full length of the scale, each graduation of which is the one-hundredth part of a millimeter. All of the delicate mechanism is carefully protected from injury by the surrounding case. Fig. 2 shows the forms of holders that are regularly supplied with the instrument. It can be used in any position desired, and it is a simple matter to so set it that the pointer shall read from the zero point. Thus it has a wide range of adaptation. This instrument is manufactured by Ludwig Loewe & Company, Berlin.

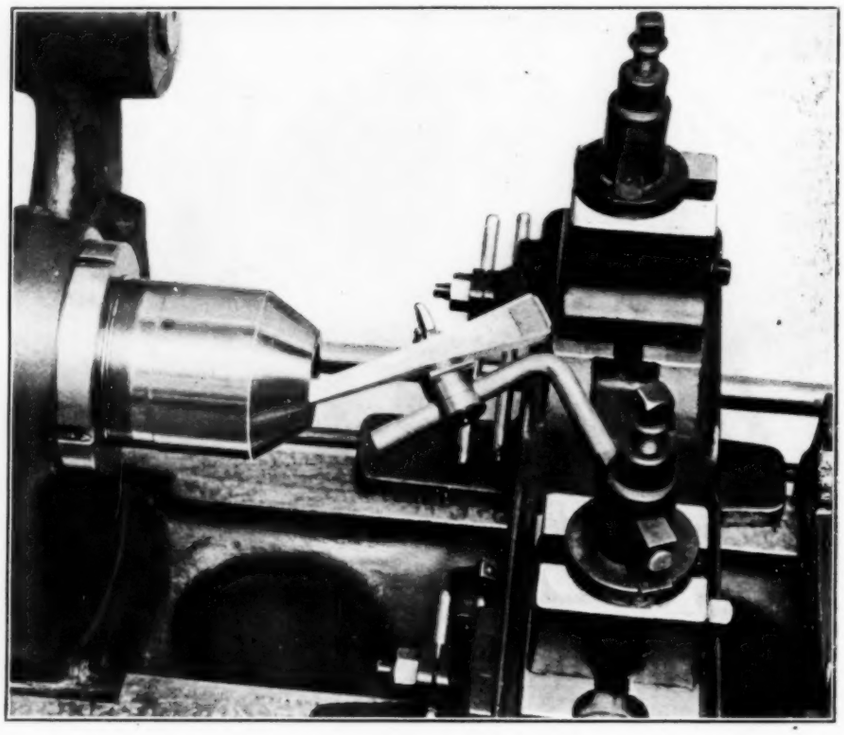


FIG. 1. A GERMAN INDICATOR IN USE IN A LATHE

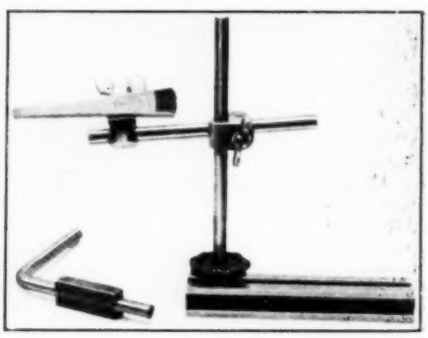


FIG. 2. HOLDER FOR THE GERMAN INDICATOR

The statistics of exportations from the United States to Germany for the fiscal year ending June 30, 1908, show a value of $276,910,223, against $256,595,663 in 1907.

Magnalium: Its Strength, Weight and Uses

Rules for Molding, Forging, Rolling and Machining. The Tensile Strength, Specific Gravity, and Materials Which Attack the Metal

EDITORIAL CORRESPONDENCE

Since aluminum first came into practical use, a great many different metals have been tried as alloying materials; and in numerous combinations to increase its strength, elasticity and density, or impart to it other properties which are desirable. Nearly all of the alloying materials increase the weight or specific gravity of that of pure aluminum. Thus pure aluminum has a specific gravity of 2.64, and the aluminum-copper or aluminum-zinc alloys, which are the alloys most generally used, have a specific gravity of from 2.85 up, according to the amount of copper or zinc used.

A new alloy called magnalium has been brought out by a German company and patented in many different combinations. This is composed of from 90 to 98 per cent. aluminum and the balance magnesium, with the exception of a small percentage of antimony and one or two other ingredients to make it roll, draw, forge, or cast easier, as the case may be. Magnesium being a lighter metal than aluminum, it reduces the specific gravity rather than increasing it, as is the case with the other alloying materials, and magnalium has a specific gravity of from 2.40 to 2.57, according to the amount of magnesium used.

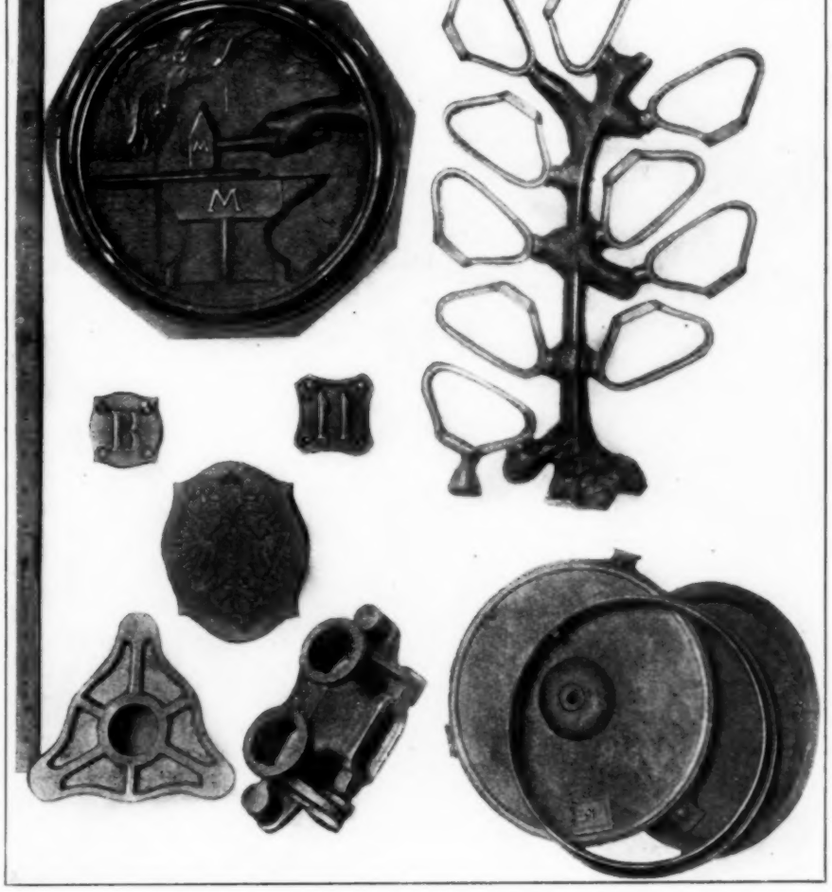


FIG. 1. MAGNALIUM CASTINGS AS THEY COME FROM THE MOLDS

This alloy is marketed in several different grades. Alloy Y is an elastic metal that is similar to yellow brass in structure, and is suitable for casting in sand or iron chills. Alloy X is harder, stronger, more brittle, and closer grained than the above and resembles red brass in structure. This alloy is easily worked and can be used for any size of casting. Both the above alloys flow readily, and can be cast in very thin sections, walls 1/20 inch thick having been cast. Alloy X½ is especially hard and suitable for work which needs great hardness and stiffness. Alloys Z and O are for forgings, O being the softest and most easily worked; it is the alloy used for drawing into very small wire, or very thin sheets. Alloys Y and X can also be forged at a very low heat.

Melting Metal for Castings

Nearly all of the rules laid down for melting and molding aluminum hold good for magnalium, and while it can be handled easily with the appliances in an ordinary brass foundry, the melter accustomed to melting brass has a tendency to overheat magnalium as it should be poured at as low a heat as possible and never heated to over 1250 degrees Fahrenheit, or a good red heat. A heat that produces an orange or a gray color causes the metal to absorb oxygen and burn, and porous, brittle castings are the result.

The crucibles should be perfectly clean, evenly surrounded with coke and rest on fireproof supports, so they will not come in direct contact with the grate and keep the metal from cooling by an airdraft after the coke burns up. The crucible should be covered to prevent air and furnace gases from attacking the metal.

The metal should be stirred with a clean pine rod and as soon as it ceases to cling to this, the crucible should be removed from the furnace and placed on a warm fireproof support so the metal will not chill from the bottom before it is required. After this the metal can be allowed to still and then be poured steadily into the mold, without ceasing, by holding the crucible close to the pouren until the mold overflows. No flux is necessary but the slag and oxidized skin should be skimmed off just before pouring. The mold should be bottom poured and dirt and scum taken care of by risers. While the melting point of magnalium is low, at least 45 minutes should be consumed in melting it.

Making Molds

The sand in the molds should be rammed very loosely so as to present as many air holes as possible. Gates should be cylindrical with wide entrances and the casting funnels and risers must be wide at the base and narrow at the top, with the casting head large. This allows the air and gases to escape easily, the dirt, slag and oxidized skin to rise easily, and the finished castings will be free from pores or blowholes. In these molds the metal should be poured quickly and at as low a temperature as it will fill the mold and the casting cooled slowly.

FIG. 2. FINISHED CASTINGS OF MAGNALIUM

When casting in iron molds they should be well cleaned and brushed with graphite. The mold should be heated and the metal poured in slowly. The metal should be hotter than when pouring in wet sand molds, as it should be a bright red color. Ingots must be cast in closed molds with planed inner surfaces. Chilled castings, especially ingots, should be cooled quickly, preferably with a cold stream of water. This makes the metal very tough and ductile.

If the above rules are closely followed it is possible to make castings of magnalium that will have a tensile strength of 40,000 pounds per square inch, which is about ⅓ greater than that of the aluminum-copper or aluminum-zinc castings made with the same care. If, however, the proper precautions and the necessary care are not taken in the melting of the metal and the making of molds, castings with a very low tensile strength will be produced and the metal will be no stronger than the ordinary aluminum castings.

In Fig. 1 will be seen some magnalium castings as they left the molds, and in Fig. 2 is shown some which have been finished. These show that the metal flows easily and fills fine depressions in the mold, and that it leaves a smooth, fine-grained surface when finished. It can also be plated.

Forgings

Magnalium can be made into drop forgings, or it can be forged with the hammer. The best results are obtained in forging by heating the metal to about 525 degrees Fahrenheit, at which temperature it will char wood but not glow red. It can then be worked about the same as swedish steel Before forging it should be pickled so as to show up any cracks which might be in the metal. In pickling it is treated at about 140 degrees Fahrenheit, for from 15 to 20 seconds, in a 10-per cent. solution of caustic soda to which has been added 2 per cent. of common salt. It is then rinsed in water brushed and dipped in concentrated nitric acid for 10 or 15 seconds, then rinsed again and dried in warm powdered sawdust. The cracks or faults can then be seen and removed by scraping and sandpapering. Pickled several times, the metal presents a dull silver-white appearance with a silky gloss and is impervious to changes in atmospheric conditions. Forging, if properly done, will give the metal a tensile strength as high as 30,000 pounds per square inch, but if it is poorly done the strength will not be more than one-half of this. As an instance of this, I have seen a forging pulled that showed a good, close grain at the break without any signs of a flaw, and the tensile strength was only 16,000 pounds per square inch.

The hook and valve in Fig. 3 are drop forgings, and the central piece is a hammer forging that has been bent and twisted to show the great ductility of the metal. The wire shown in the top of the view was bent and tied into knots to show the ductility, and the ingots shown are one of the forging alloys.

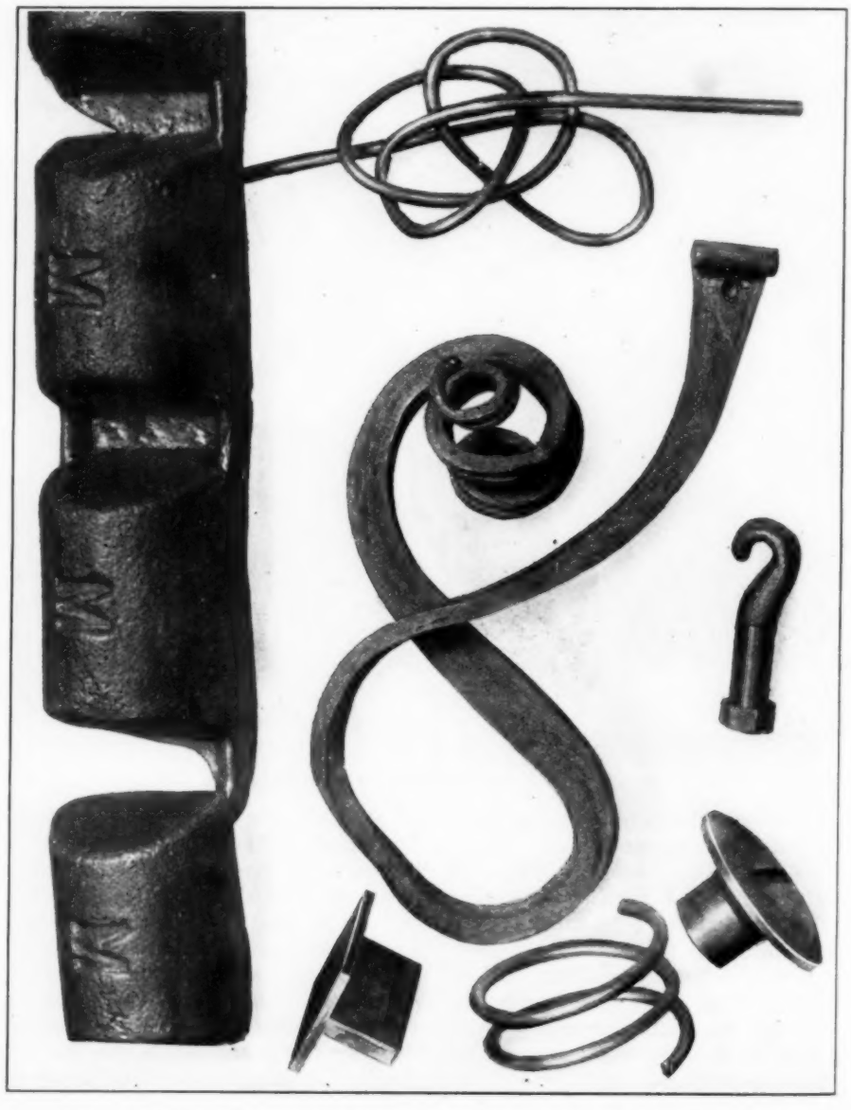


FIG. 3. INGOTS, FORGINGS AND SPRING WIRE, WIRE BENT TO SHOW DUCTILITY

Rolling

As the metal is very ductile it can be rolled into plates of any thickness, but it rapidly loses this ductility in rolling and has to be repeatedly annealed. If possible the ingot should be worked down with a hammer before rolling, and all roughness of the surface scraped, as is done with copper and brass.

In rolling, the ingots should be heated to from 570 to 660 degrees Fahrenheit, and reduced about 20 per cent. in the first

FIG. 4. WIRES AND FORGED BAR PULLED TO SHOW TENSILE STRENGTH, ELONGATION AND REDUCTION

pass, then heated again, given another pass and annealed. After this it can be turned 90 degrees and passed through the finishing rolls until it reaches the required thickness. Plates thicker than 0.15 inch must be annealed after every pass, but thinner plates can be cold-rolled.

The rolls must be well cleaned and sprinkled with paraffin for each pass, and if they are heated to about 300 degrees Fahrenheit, the rolling is more easily done. The power necessary for running the rolls is about the same as that used for heated steel.

To anneal plates a high temperature is not required, and the thinner the plates the lower will be the necessary temperature. They should be annealed in an even heated muffle furnace, to keep the flame and gases away from the metal, and heated to a dark red that will char a pine stick so the carbon particles will separate from it. If chilled in cold water they will be very tough and ductile. Plates less than 0.01 inch in thickness can be annealed by heating in boiling oil or water, and then allowed to cool slowly, but thicker metal must be quenched to anneal them.

Strengths of Plates and Wire

Plates made with the proper care will show a tensile strength of about 50,000 pounds for the hard rolled and about 40,000 pounds for the annealed.

Drawn into wire the metal gives a tensile strength of about 50,000 pounds per square inch for the smaller sizes, but this decreases very rapidly as the diameter increases. The upper wire, shown in Fig. 4, was 0.079 inch diameter, and showed a tensile strength of 50,500 pounds, and an elongation at rupture of 2.13 per cent.; the third one from the top was 0.118 inch in diameter; it had a tensile strength of 43,800 pounds, and an elongation of 0.61 per cent.; and the second wire from the top was 0.197 inch diameter, and gave a tensile strength of 39,500 pounds, with an elongation of 2.5 per cent. The forged bar was 5/8 inch in diameter, and only showed 16,800 pounds tensile strength. This, however, was a poor specimen, and pulled below the average strengths of forgings.

Magnalium can be made so hard and elastic that it can be worked into springs by gradually heating to a temperature of 750 degrees Fahrenheit, and slowly cooling. The wire coil at the bottom of Fig. 3 is a piece that has been treated in this manner.

Machining

The metal can be machined with tools at high speed about the same as steel and a cut 1/4 of an inch deep can be taken on an inch rod without its bearing away from the tool. The tools must be kept very sharp and the metal and tools kept lubricated with the same lubricants that are used for aluminum. A fine-toothed saw well lubricated is recommended for cutting up the metal.

Fine screw threads can be cut on the metal and good sharp, clean threads obtained without the metal tearing up as in aluminum. The two threaded rods in Fig. 2 have 36, 32 and 20, and 20, 12 and 32 threads to the inch, respectively, and 64 threads to the inch have been easily cut on microscopic lens holders. The file makes a good clean cut and does not clog as when filing aluminum.

A great many corrosive materials have been tried on magnalium and but few of these have any appreciable effect. Those that do are 1 per cent. caustic potash, 8.55 grains per 100 square inches in 1 hour; nitric acid, specific gravity, 1.4, 7.85 grains in 20 hours; 2-per cent. solution of sodium carbonate, 6.6 grains in 7 hours; 1/10 normal solution of sulphuric acid, 4.1 grains in 16 hours; 20 per cent. oxalic acid, 3.25 grains in 23 hours; and hot tar, 1.6 grains in 5 hours.

Conclusions

Magnalium is not a metal that can be handled carelessly, in the many different operations it goes through from the raw material to the finished product, if one is to get the desired results from it, and hence it cannot be called a cheap metal, but where lightness is the main factor it has no peer.

When carefully manufactured and the product is of small section its tensile strength can be made nearly equal that of the brasses and some bronze, but when a thick section of metal is required in any given product this strength per square inch is greatly reduced, as in aluminum, as the greatest strength of the metal lies in the outer shell, while the core is comparatively weak and the thicker the section the weaker will be the core.

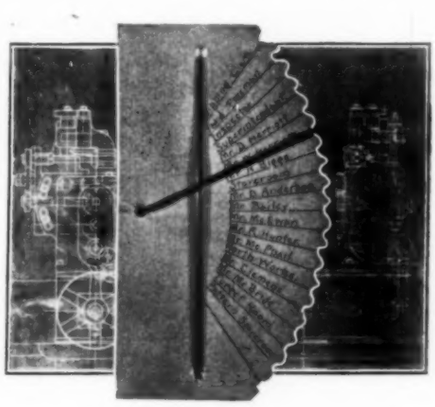
For this reason parts that are designed of magnalium should be of thin section well ribbed and filleted rather than of thick sections of solid metal.

Its ability to withstand vibrational strains is, like aluminum, very low and hence a large factor of safety should be allowed when it is used on any moving parts of machinery and if it is submitted to careless workmen in its manufacture this factor of safety will have to be that much larger.

E. F. L.

Direction Tag for Shop Mail System

The Goldie & McCullough Company, Ltd., Galt, Ont., Canada, have a very neat device in connection with their shop-mail system. The tag shown in the illustration consists of a heavy card, printed and notched, as shown, and having two rubber bands, the long one for holding the message, or drawing, while the other



TAG FOR SHOP MAIL SYSTEM

shows the party for whom it is intended. In this case the letter on the other side is for W. Herriott. Another and different list of names is given on the other side, but the letter being over these names indicates that the person named is to receive it on the next delivery. The mail is delivered in half-hourly trips and this tag saves all writing of names on the parcels.

Interesting Textile Machine Work

Details of Some Novel Braiding Machines Which Have Interesting Problems in Gearing and Other Mechanical Movements and Control

EDITORIAL CORRESPONDENCE

To anyone not familiar with textile machinery, and particularly machinery for making braids of various kinds, a visit to the Textile Machine Works in Wyomissing, which is right across the Schuylkill river from Reading, Penn., is sure to be of interest. In the braiding of any material around a central body, as in insulating wire, the operation can easily be compared to the winding of the May-pole as is often done at church fairs and similar places. In the braiding machines the children are replaced by bobbins carrying the threads, and these must be moved automatically in and out so that each thread will cross at exactly the right interval. When it comes to making flat braids, the operation is exactly the same excepting that the bobbins do not go round and round continuously, but go to the end of their path or track and are then brought back, as can be seen in Fig. 1, which is known as a 12 + 9 + 12 carrier stripe braider. This track is made on a circular plate so as to make the machine more compact, and also to prevent the varying lengths and angles of the threads running from the bobbin to the point of weaving. To see these machines running at high speed reminds one of a ball-room, in which the dancers are madly waltzing round and round, dodging each other in the most skilful fashion, and seemingly avoiding collision only by a hairbreadth.

These tracks are made from boiler plates about three-eighths inch thick, are carefully laid out and punched to as near the exact outline as possible, and represent nice work in this way. The center pieces are supported on studs, which must hold them rigidly in the right position and all must be finished so as to make a smooth track for the rapidly moving bobbin carriers. Fig. 1 shows a comparatively plain braiding machine, in which the bobbins always move in the same path, making a fixed design of braid.

For weaving fancy designs it is necessary to introduce switches and interlocking devices so that certain bobbins can be switched off at the proper time to weave the desired figure, and this is accomplished in much the same way as in weaving designs on looms by means of the Jacquard device. Before going to that, however, it may be interesting to look at Fig. 2, a 10 + 25 carrier corded edged braider, and see some of the complicated track designs which are necessary for some kinds of braids. In this machine the two outer circles have been cut off, so as to make a slight change and at the same time allow the machine to be used the other way when desired. This also gives something of an idea of the class of designing which a man is up against in this line of machinery, for he must make an entirely different runway for each design of braid that is submitted.

Fig. 3 shows a comparatively plain design with a number of switches, which can be seen at A A A A and are controlled by the mechanism at the end operating under the plate. This is for braiding the covering for telephone cords and has 48 carriers.

Fig. 4 is a rather complicated machine, a 49 carrier braider, having a double row of tracks and a large number of switches, which are controlled from the two Jacquard attachments at the upper corners and which somewhat resemble typewriters. These switches, as can be seen on close examination, throw the bobbin carriers first from one series of tracks to the other, and make a very complicated movement, which is all the more amazing when seen in rapid operation.

Fig. 5 shows the underside of this plate, with the numerous rods running from the Jacquard attachment to the switches, each of which is counterbalanced by a spiral spring. The designs are perforated in cards in the same way as the weaving loom and somewhat similar to the tunes on the various piano players now on the market, and when these holes come in line with the small rods of the attachment it allows them to go through and operate the switches so as to change the direction of the bobbins.

Fig. 6 gives a better idea of the way in which these are driven than any of the other views, and as will be seen, represents a large machine for this purpose. This has 96 carriers and is for braiding the fabric for rubber hose. At the time of

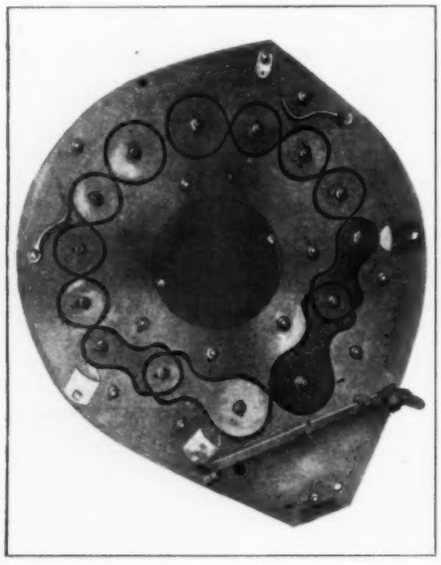


FIG. 1. A 12 CARRIER STRIPE BRAIDER

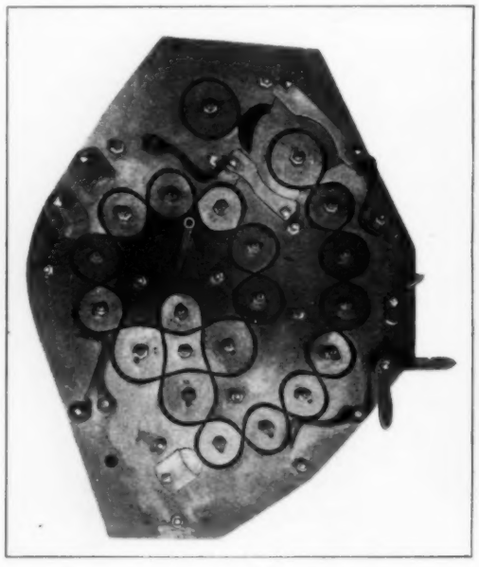


FIG. 2. A 10X25 CORD EDGE BRAIDER

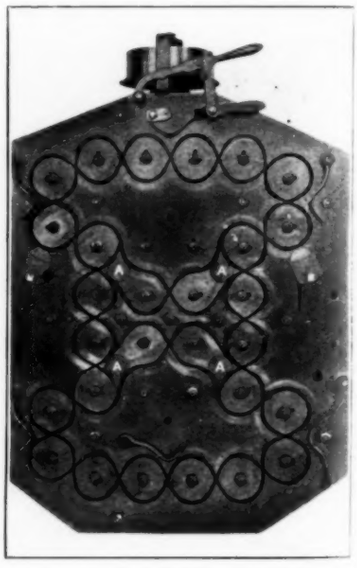


FIG. 3. A 48 CARRIER TELEPHONE WIRE BRAIDER

my visit they had a machine carrying 240 bobbins, and making straw braids for trimming ladies' hats, which is supposed to be the largest machine of this kind ever built. The straw, by the way, was entirely artificial, being made in some way from wood pulp, so as to secure a continuous ribbon, and to all appearances it was as good as genuine straw. As will be seen in Fig. 6 the body of the machine consists of two plates held at the right distance apart by being bolted on thimbles. The gears underneath are for driving the bobbins, and although they are geared continuously, they are driven from several points so as to avoid lost motion toward the end of the track.

The way in which these bobbins are driven is shown in Fig. 7, in which a group of drivers having three, four, five and six horns have been assembled, these being known as the universal terminal change gears. Difference in design calls for different kinds of drivers, and the bobbins must be moved continuously from one to the other, so that there may be no hitch in the performance. To secure this the horns have beveled edges, as can be seen, but so arranged that they always break joints and present a continuous driving surface to the bobbin when it comes between them and passes from one to the other.

These are located directly beneath the track, and these gears run on the studs which hold the center pieces in place, so that the bobbin in this case would be caught at *A*, carried around to *B*, be forced by the track above to go with the intermediate gear to *C*, and be here transferred to the six-point driver. In this case the three-horn driver would not be utilized and is only photographed in this group to show its operation.

Fig. 8 shows the gear end of these drivers and also an extremely interesting problem in gearing. In fact, the designer informs me that their plan of interchanging on different design machines would be impossible if it were not for their use of the Fellows gear shaper in this particular case. These are all cut with an 8-pitch cutter, the central pinion having 24

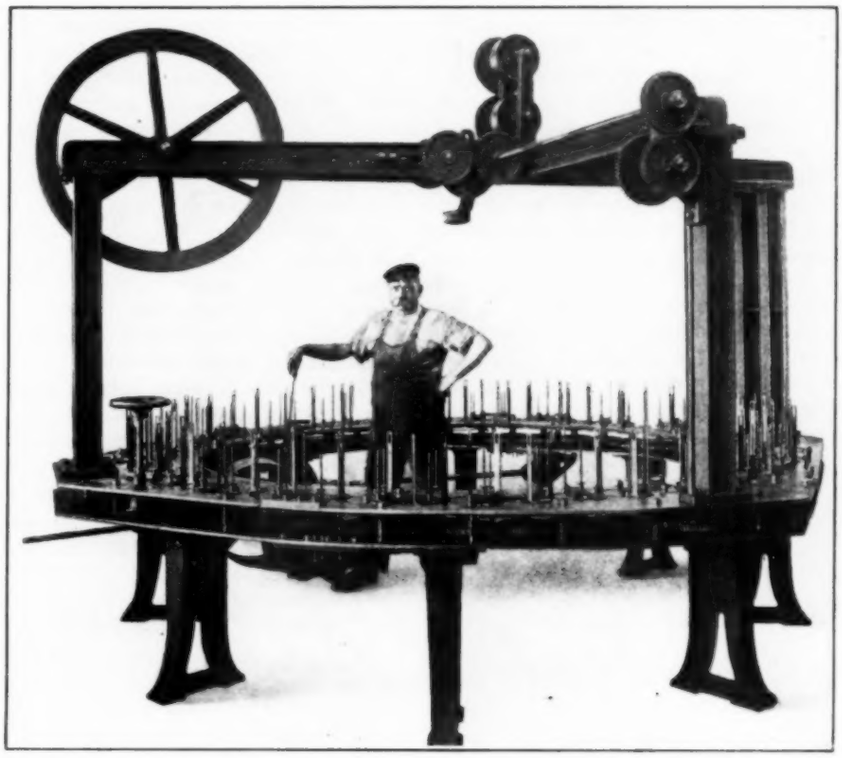


FIG. 6. A 90-CARRIER RUBBER-HOSE BRAIDER

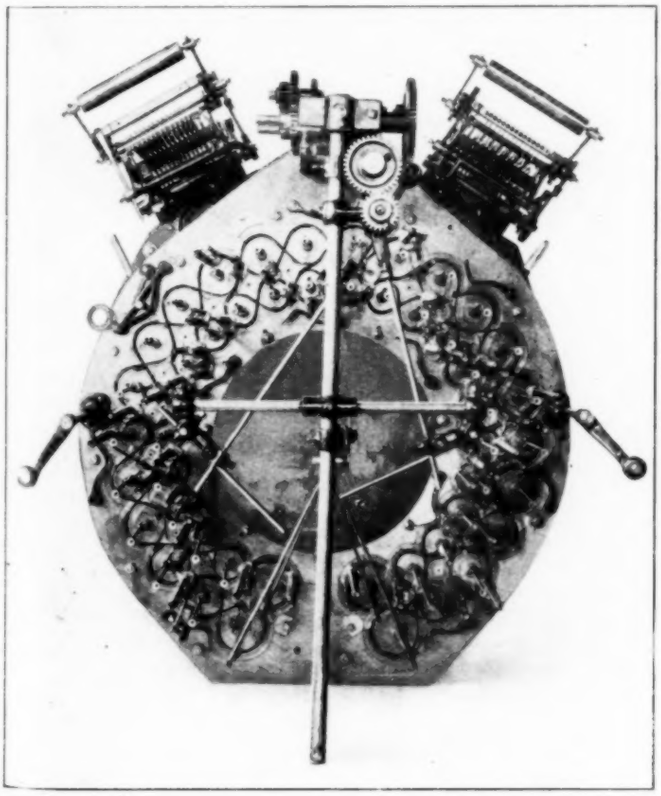


FIG. 4. TOP VIEW SHOWING THE 44-CARRIER BRAIDER

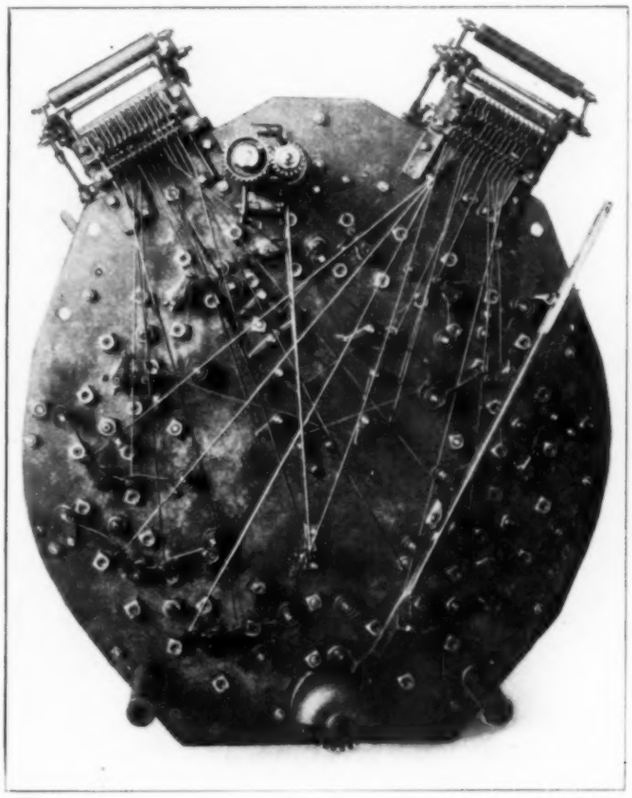


FIG. 5. BOTTOM VIEW SHOWING THE LEVERS CONTROLING SWITCHES

teeth, the right-hand gear 36 teeth, and the left-hand gear 30 teeth, all cut with the same cutter. It is necessary for the right and left-hand gears to interchange in the gear train so that they must be the same diameter. It is also necessary that the number of teeth vary in accordance with the number of horns on the other end. So they turn both blanks to the same outside diameter, 4½ inches in this case, use an 8-pitch cutter and cut 36 teeth on the six-horn blank, and only 30 teeth on the five-horn blank. These gears will both run with a standard gear, as can be seen, but will not run with each other, and whatever can be said, for or against the form of teeth which are developed by this process, they run very nicely in this particular case and afford an easy solution of what would otherwise be a very difficult proposition.

Trade Opportunities in Cuba and Panama

By M. de Moreira

Cuba, the republic which has obtained its freedom through the efforts of Uncle Sam, should be of great interest to our manufacturers, on account of the large amount of American capital employed there and of the great facilities for representation and transportation. Many American manufacturers have either gone themselves, or sent their representatives to Cuba during the last ten years, and have been moderately satisfied with the results. They claim that Cuba is only good for general merchandise and offers little or no interest at all to manufacturers of machinery or machine tools. This is only partially true. No doubt, general merchandise has a greater field, the same is true in every country, but Cuba's plans for the future and actual opportunities should result in a great benefit to the American manufacturer of machinery.

Under the administration of Governor Magoon, the economic situation of Cuba has been more than satisfactory. The American manufacturers who did business with Cuba were afraid that the financial credit of the island had been destroyed through the revolution, long continued drought, cyclone, etc. Such, however, is not the case. The island has produced more sugar in 1907 than ever before; tobacco has been of the most superior quality and everything in general has prospered, resulting in good financial credit. The total of the foreign trade of the republic for the year was valued at $208,259,972, or an increase of over six millions over the preceding year. Out of that total the imports amounted to $104,460,935 and exports $104,069,037, also a great increase over 1906.

Naturally the United States leads the imports, having furnished mechandise to the sum of $51,309,288, or 49.1 per cent.; an increase of about one per cent. over the year previous. Among these fifty millions of imports from the United States I will select the following, as of interest to iron and machinery manufacturers: Pipes and fittings, $1,111,663; passenger cars, $845,229; steam engines and machine tools, $716,666.

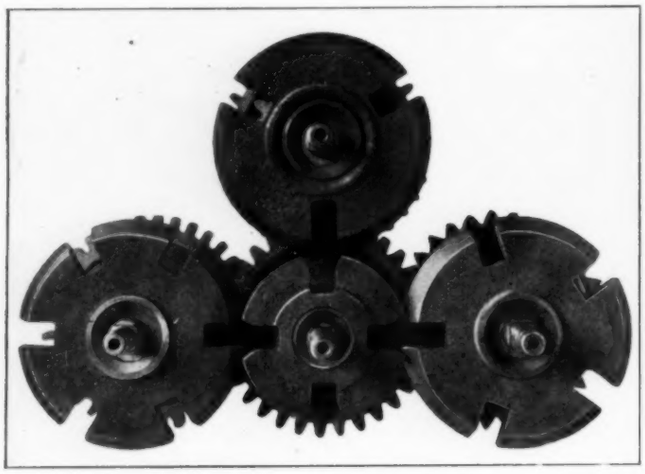


FIG. 7. LOWER SIDE OF UNIVERSAL TERMINAL CHANGE GEARS

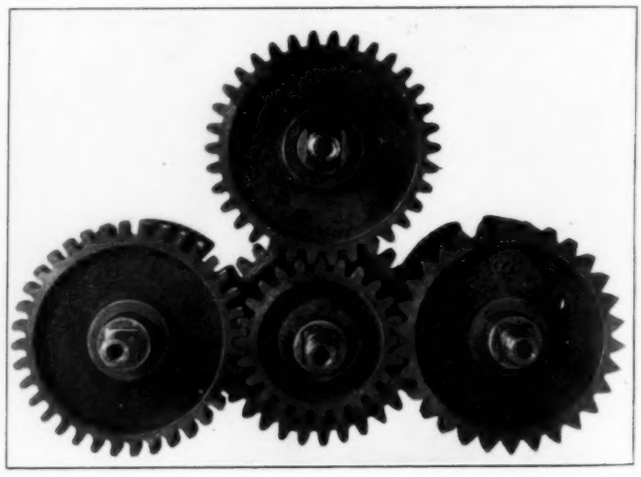


FIG. 8. UNIVERSAL TERMINAL CHANGE GEARS

Leaving out tobacco, sugar is undoubtedly the principal product of the republic, the latest statement of the ownership of Cuban sugar plantations, meaning those which are producing sugar and not cane alone, assigns 36 to Americans, 76 to Europeans and 74 to Cubans. The total machinery imported in 1907 to meet the demands of that trade was $1,299,040, which means that as the crop of 1907 has aggregated 1,427,673 tons, there will be an easy outlet for sugar machinery, among these planters and manufacturers, and also among the new planters or among the smaller ones who are not counted in the above list and who undoubtedly use most primitive machinery.

Leaving aside the sugar interests, which after all benefit only one kind of manufacturers, Cuba has in many points followed the example of Brazil, and has entered upon an extensive plan of public improvement. There was much to improve and the Cubans have gone at it with a vigor, which shows that American energy and progress are bearing fruit in the island. The last appropriation the Government has made for harbor work, lighthouses, etc., amounts to $1,007,750. This sum, of course, is independent of the fund already existing for such work. American machinery is of absolute necessity for the digging in the harbor. Its substantial design resists damage from the corals. American manufacturers should, therefore, take the trouble to follow closely the giving out of contracts for that kind of work in order to have the contractor visited by one of their representatives and bid for the furnishing of the machinery necessary for the undertaking.

Many portions of the island are not supplied with transportation facilities and the department of Public Works is preparing a plan for roads running north and south communicating with the highway which, in its turn, runs east and west. These roads will terminate at the harbors of the six provinces. These plans include equipment of the harbors for handling cargoes and also repair shops for railroad and maritime necessity. It is estimated that the Government will expend no less than $75,000,000 for these improvements. Different small railroads in the provinces of Matanzas and Santiago have need of machinery and machine tools; both for building and repairing.

Panama

There is another republic in Central America which is of great interest to manufacturers; that is the Republic of Panama. This republic has also been prosperous during the current year. The total of the foreign trade of the republic during 1907, aggregated $19,165,648, of which the imports were valued at $17,204,983 and exports $1,960,664. Again the United States is the first among the list of the importers, with $5,196,964, or 54

per cent. of the total imports. Of course, this sum refers to dutiable merchandise, as the United States imported into the canal zone, free of duty, $7,640,533 of machinery and machine tools.

The district surrounding Boca del Toro has now in operation 175 miles of railroad; besides this they have begun lately another extension of 75 miles. The Panama railroad and steamship line, which is also very progressive, is planning to renew some of its stock and American manufacturers will find in this an opportunity not only for supplying rolling stock, but for tools as well.

A new line of steamers has also been started between Boca del Toro and Puerto Limon and weekly communication by steamers between these ports is now effected. The United Fruit Company, which has many contracts in Cuba has obtained the privilege of erecting a large concrete-steel wharf and warehouse, also the right to build a railroad from Almiranto to Banana river and then to connect with the company's railroads in the Changuinola district. This line should be about 20 miles in length.

It is not worth while to speak here of machinery used in the construction of the canal, as it is entirely home work, familiar to all manufacturers of machinery as well as to the manufacturers of machine tools.

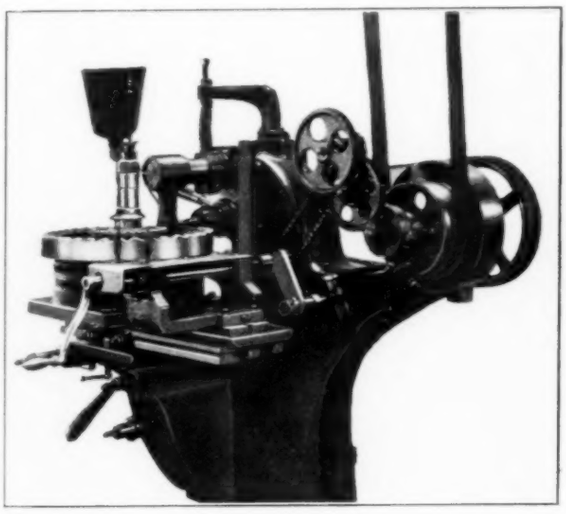
Regarding the banking facilities, American manufacturers can have all the accommodation they desire. America is in such close touch with both Cuba and Panama, banking information as to standing, etc., is easily obtainable. More especially in Cuba and Panama would I recommend to the manufacturers that they use all the tact possible in the dealings with the natives, also have their catalogs in Spanish and modify the style of their business correspondence in order to avoid the American curtness. Make it more effusive. There has been so much Americanism, more or less imposed, in these two republics that with their acute-feeling nature, the natives will more than appreciate this tactful treatment from American manufacturers.

Tooth Rounding Machines

By Ethan Viall

The idea of rounding, or beveling, the ends of the teeth of gears, used in sliding gear mechanisms, is as old as the sliding gear itself, and the developing of the idea of doing this rounding in an automatic machine was not far behind, although there is a wrong impression that the machine makers over the water were ahead of us in this respect.

The accompanying illustrations show machines that have been in constant use for several years, and which were designed and built by the Thomas B. Jeffery Co., Kenosha, Wisconsin, especially for rounding the ends of the teeth of the gears used in the transmission on their Rambler automobiles.



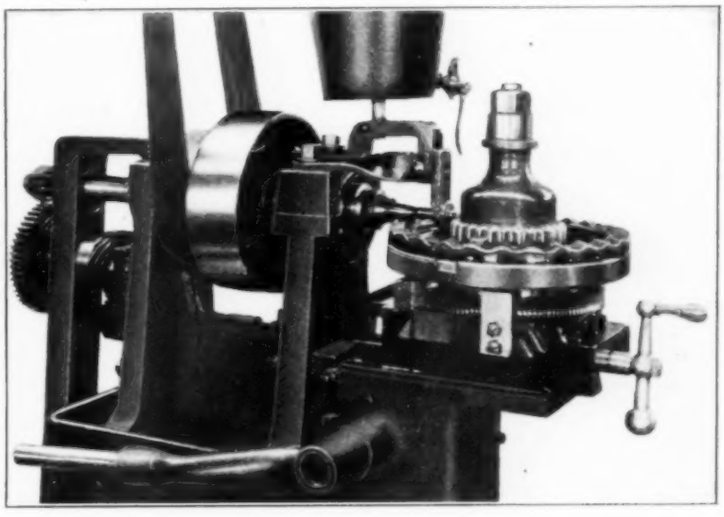


FIG. 1 MACHINES FOR ROUNDING THE TEETH OF TRANSMISSION GEARS FIG. 2

These machines, when once set, do their work quickly and smoothly, and are entirely automatic in their rounding action, and they are so simple that only a boy is needed to look after them. The rounding cutters used in these machines are made especially for this work, and resemble, to some extent, a combined center drill and countersink.

The two machines shown were built at different times and are not exactly alike, though both operate in a similar way.

Fig. 1 is a right-hand view of the first of these two machines, and two of the milling cutters are shown standing on end on the table, just in front of the cam ring.

As will very readily be seen, the rounding action of the cutter is produced by means of a circular cam or ring, having as many rises as there are teeth in the gear, the cutter spindle being so made that it rises and falls with the rotation of the cam ring.

The gear to be machined is bolted securely in the center of the cam wheel as shown, and with its teeth in line with the rises, and it, together with the cam wheel, is driven under the revolving cutter and spindle by means of the worm and worm gear partially shown under, and at the left, of the cam wheel.

The collar, on the spindle, that follows the cam motion, is made taper, so that if it is desired to cut more off the ends of the gear teeth, the table is drawn back, which allows the spindle to drop lower. If too much is being cut off the table is run in.

This, with the setting of the cutter in or out, and the adjustment of the hight of the gear itself, gives any desired degree of roundness, and once set, the machine needs no further changing for the same sized gears.

The using of this form of circular cam to give the up and down motion to the cutter, of course necessitates a separate cam ring for each gear of a different number of teeth, but for special work, such as in this case, where the number of gears is limited in variety but not in amount, the use of separate cam rings is no drawback. In fact, they have considerable advantage over a machine operated by change gears and a cam with a single rise, of which there are several in use, to my knowledge, and all American-made, though not as old as the Jeffery machines.

Fig. 2 shows the second machine viewed from the left, and it gives a little better view of the cutter and the taper collar on the spindle. In this machine, as will be noted, the cam wheel and gear, and not the spindle, have up and down motion, as in the first one. The heavy coil spring used to operate it is plainly shown under the table.

This was the first machine built and while it shows some faults of design which were corrected in the next one built, yet it is still doing good work and will continue to do so for a long time.

Practical Letters From Our Readers

A Round Table Discussing Details of Modern Machine-shop and Drawing-office Methods, Practice and Economy

WE PAY FOR USEFUL IDEAS

Worm-milling Attachment

The drawing shows a worm-milling attachment which I designed and built for a No. 4 Cincinnati Universal Milling Machine. The attachment is applied to the dividing head and by the use of necessary gearing will cut worms of the finest pitch and from the smallest diameter up to and including work 14 inches diameter of 1.047 pitch, at a single cut. I built the attachment because the feed for cutting spirals is too coarse on most milling machines, for fine pitches. A connection is made at *A* with the knuckle joint, then the drive is transmitted through a pair of spiral gears on a shaft *B* to another pair of spiral gears; then through the gears to quadrant *C* which changes for right- or left-hand worms, then through shaft *D* across the top of the dividing head to gear *E*, which also has a clutch for stopping the work at will. Gear *E* runs loose on shaft *D*, while the clutch slides on a feather. Gear *E*, connects with the dial plate *F*, which has gear teeth cut in the edge and imparts a steady motion to the work while under the cut. Through the gearing *G* which usually drives the work, the drive is taken down to the lead screw, which gives a very easy drive, for instead of gearing up to drive the work we are cutting down and speeding down to the lead screw, thus making it easy on the head. It is used with the regular universal head.

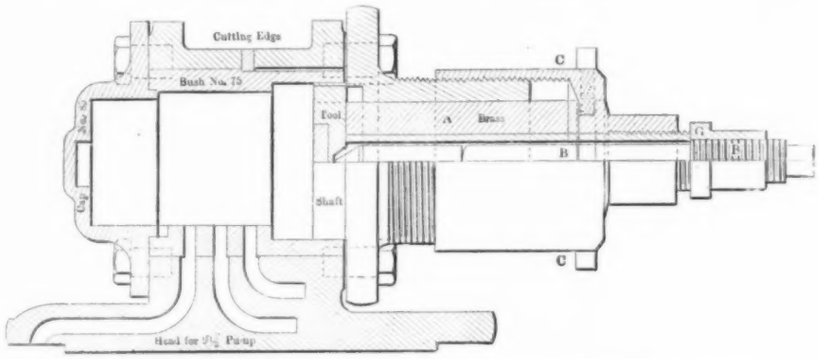
Newark, N. J. N. B.

Repairing Air Pumps

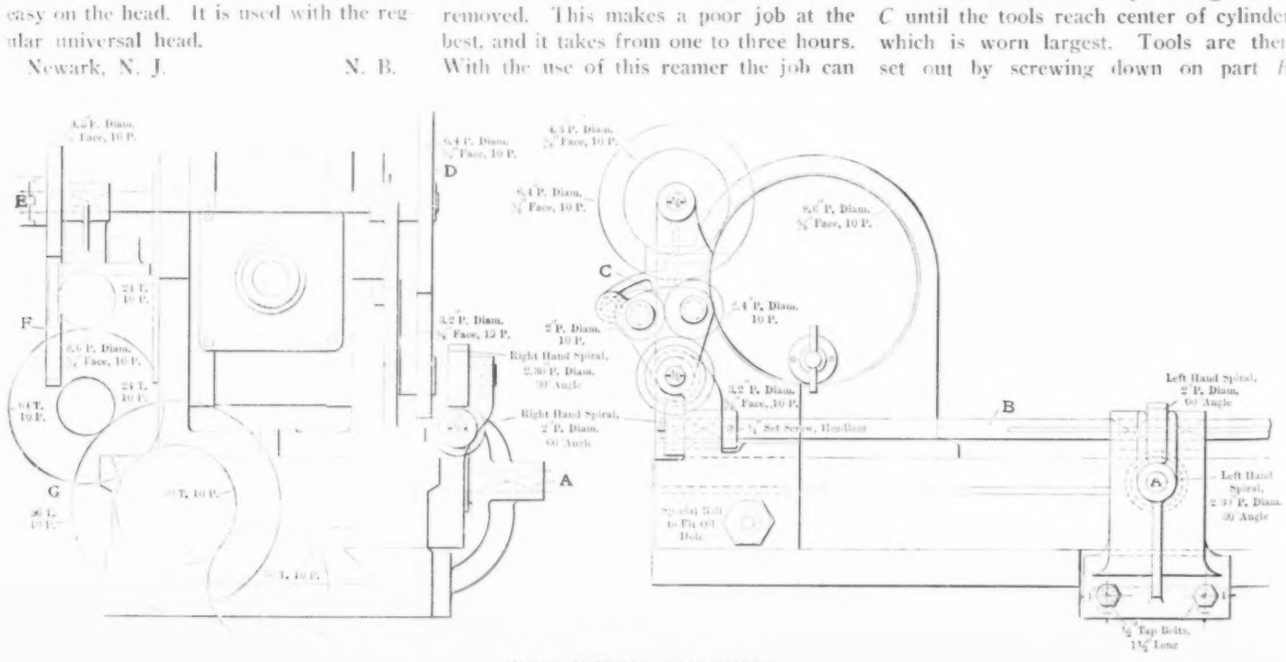
In making repairs to air pumps the most important repair is in the top head; in fact the top head is the whole works. The parts most subject to wear are main bush No. 75, packing rings Nos. 78 and 80, and left main-valve cylinder-head.

On all pumps that come to the shops for repairs the main bush is more or less worn, and on account of the valve seat in center of bush, it is impossible to ream or file this bush out true. The only way it can be machined is to bolt the top head to angle plate, or remove bush from head and chuck it in lathe. Either is an expensive practice. The common shop practice is to scrape and file until shoulder is removed. This makes a poor job at the best, and it takes from one to three hours. With the use of this reamer the job can be done in from 10 to 20 minutes in a mechanical manner. By changing tool in end of shaft the reamer can be bolted to left main-valve cylinder-head No. 85 and cylinder portion of this trued out.

Main shaft *A* is the size of cylinder portion of main bush No. 75. In the end of this shaft are inserted tools *F*, then apply part *G*, which acts as tool-post screw, as it holds tool in place. Parts *B* are then applied. Shaft is then placed in part *D*, bonnet *C* screws down over *D*, set-screws in *C* are set in to engage shaft *A*. Reamer is now ready for service. Bolt reamer on head with screw bolts which holds cylinder-head No. 84. As reamer is applied shaft and tools just enter bush and hold reamer central while being made fast. The shaft is then fed in by turning bonnet *C* until the tools reach center of cylinder which is worn largest. Tools are then set out by screwing down on part *B*



REAMER FOR MAIN BUSHING AND CYLINDER-HEAD CAP 9½-INCH AIR PUMP



WORM-MILLING ATTACHMENT

until it is felt that tools are touching all around. Now clamp tools by screw *G*, which also acts as drive for reamer. By using ratchet wrench on *G* and turning bonnet *C*, reamer is fed in as far as it will go, then feed back to outside of bush and the job is done.

This tool is no experiment, as I have been using it for about two years, and it gives perfect satisfaction.

G. E. McLaughlin.

Huntington, W. Va.

Chamfering Washers in the Drill Press

The illustrations herewith are of jigs that were designed for use on the drill. The tool is a hollow mill, shown in Fig. 1; this is provided with a stem, not shown. Fig. 2 shows a jig for holding washers which have D-shaped holes, such as are used on brass cocks, and other goods; the body *A* is of gray iron, and is fitted with a cast-steel peg *B*, to suit the hole.

Fig. 3 shows in plan and elevation a jig for washers with round holes; these need more holding than D- or square-hole washers. *A*, the body of jig, is of gray iron, machined top and bottom, and bored, to take the post *B*, which should be a good fit in *A*. *B* is of cast steel, turned all over, and is threaded to take a nut at its lower end. The upper end is turned to a taper of 60 degrees. It has also an enlarged part which is threaded with a coarse thread, as shown; this thread engages with the lower end of the spring chuck *C*.

The spring chuck is furnished with a handle to operate it. At its upper end it is made to fit the washers to be chamfered, one of which is shown in position. When in use the operator places the washer on its seat, and by turning the handle expands the chuck, thus firmly holding the washer in position. About one-third of a turn suffices to hold the washers, in the case of larger work, from thicker stock, where more stock had to be removed; the gripping part of the chuck was nurled to make sure of a good grip.

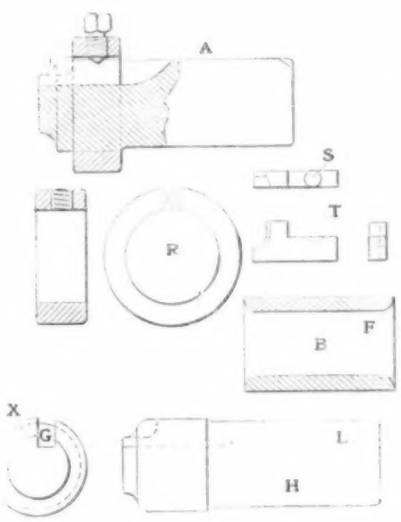
Wilfrid George.

Birmingham, England.

Tool for Turning Inside Fillets

The tool shown herewith for turning inside fillets was designed especially for bushings, as shown at *B*. The tool is shown assembled at *A*.

The retaining ring *R* is made of machine steel. The cutting tool *T* is of



TOOL FOR TURNING INSIDE FILLETS

hardened tool steel. The conical point set screw passes through the retaining ring *R* and its point enters the countersink in the tool at *S*. This prevents the tool from ever sliding out of place.

The holder *H* is of machine steel and fits the turret lathe at *L*. A groove is cut at *G* to carry the tool and the stock is cut away at *X* for chip clearance.

This tool has proved exceptionally valuable for turning accurate fillets, such as shown at *F*. It is far ahead of the filleted reamer because the small tool *T* may be replaced when ground too much, and the ring and holder remain as good as ever. The filleted reamer, when ground until the radius of the fillet becomes too great, must be discarded entirely and that seems to be useless waste of good material. This tool also finishes the ends of the bushings, thereby saving one separate operation which would otherwise be necessary.

Reuben Benjamin Lovejoy.

Washington, D. C.

Making an Ordinary Lathe into a Collet Lathe

It quite frequently happens in the average toolroom or machine shop that there is a scarcity of collet lathes to meet the requirements. This is perhaps more often the case in the toolroom. In the building of jigs, fixtures, dies, gages, etc., the collet lathe is certainly an indispensable tool, and in the shop where there happens to be only one, it is a case of wait, most of the time. Now any ordinary hollow spindle lathe can be quickly and cheaply converted into a first-class collet lathe by making a fixture similar to the one shown in Fig. 1.

A represents the lathe spindle which in our case carried a center about 1⅛ inches diameter at the small end. To this center we fitted the hardened and ground taper sleeve *E*. This sleeve was ground to fit collets we used on other lathes. As this rig admits of much larger size collets than the ordinary draw-in collet lathe, we made up some extra sizes. The machinery stub sleeve *B* was next fitted to the spindle, and by means of a spanner wrench screwed up tight to the shoulder. This sleeve has a fine thread on front end

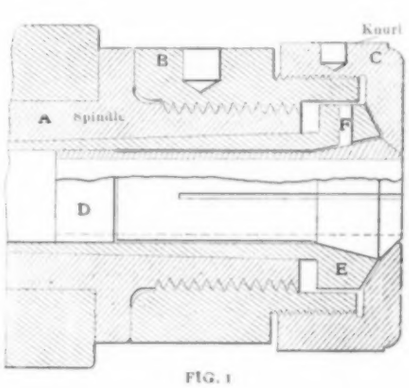


FIG. 1

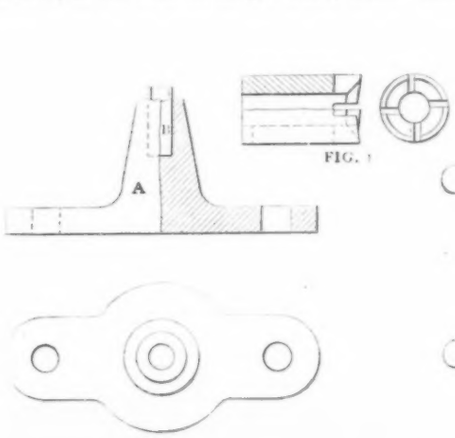


FIG. 2

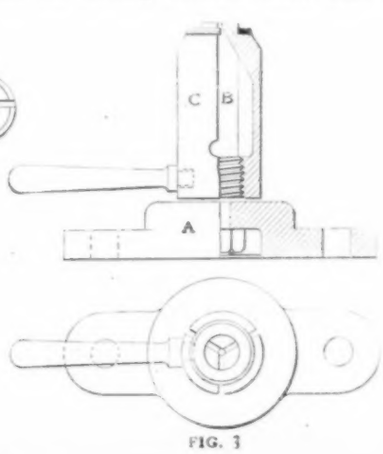


FIG. 3

CHAMFERING WASHERS ON THE DRILL PRESS

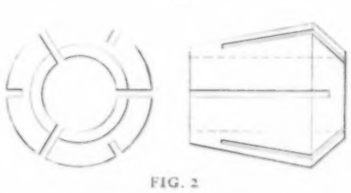


FIG. 2

THE COLLET AND CLOSER

to which a cap *C* was fitted having a taper to match the front end of the collet. The working of this rig must be apparent at sight. Both tapers of the collet being used and as the cap *C* is made with a fine thread (20 per in.) a very powerful grip is obtained. A spanner wrench is fitted to the cap *C* also. We have used this chuck quite extensively in our shop, and most of our men prefer it to the ordinary draw-in collet. It is nearly as rapid in manipulation, is very stiff and rigid, and for holding power it has the collet lathe beat a mile.

Where the use of long bars is not required, an ordinary small center lathe with no hollow spindle can be used by extending the sleeve *B* and fitting it to a short collet as shown in Fig. 2. The sleeves *B* and *C* should be made of machinery steel, case-hardened; a pin *F* forms a key to prevent the collet *D* from turning.

Utica, N. Y. A. READ.

Screw-slotting Attachment for the Lathe

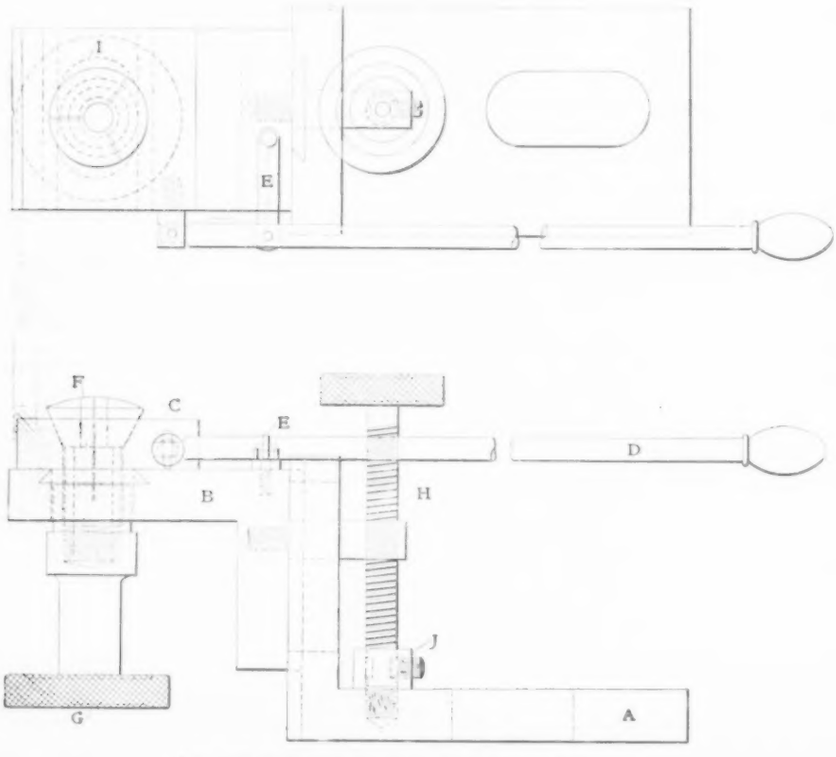
The accompanying drawing shows a method of converting an old lathe or speed lathe into a screw-slotting machine.

The angle plate *A* is secured in a longitudinal position to the bed of the lathe. In the vertical face of the angle plate is a dovetailed groove in which angle plate *B* is fitted so as to have an up and down movement. On the top face of *B* is a dovetail groove in which plate *C* slides.

Lever *D* pivoted on *E* is adapted to move to and fro. The screw to be slotted is placed in draw chuck *F*, and the latter tightened by nurled wheel *G*. The fixture is so placed on the lathe bed as to bring the screw central with the cutter carried by the spindle. The depth of the slot may be regulated by adjusting screw *H*. Upon moving lever *D* the screw is fed into the saw. There is an elongated slot *I* in angle plate *B* to allow the draw chuck to pass through and move back and forth during the slotting operation.

In angle plate *A* there is a stud *J* to hold adjusting screw *H* in position. After a little practice the screws can be slotted very rapidly.

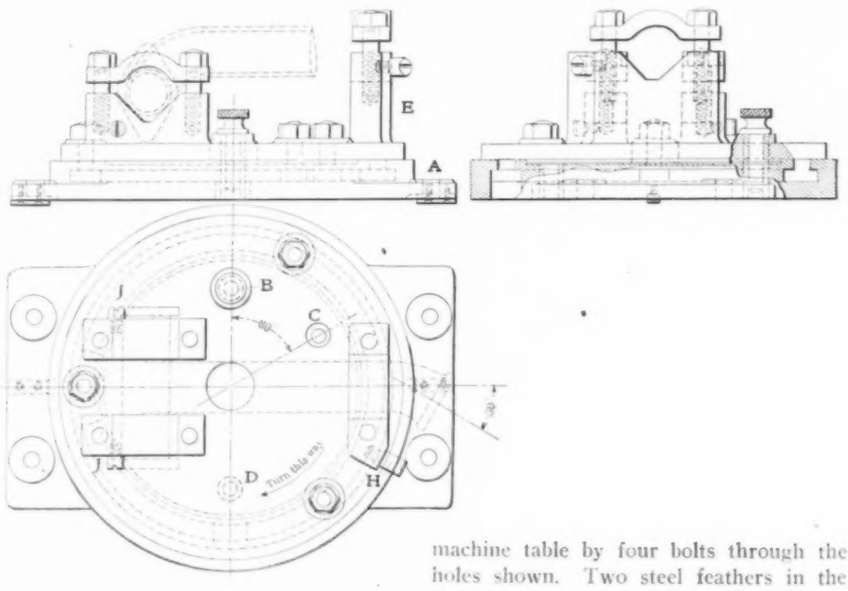
Washington, D. C. H. D. CHAPMAN.



SCREW-SLOTTING ATTACHMENT FOR THE LATHE

Jig for Finishing Faces of T-pieces for Automobile Exhaust

The jig was designed for use on an ordinary milling machine, using an inserted-tooth face cutter. It consists of a cast-iron base *A* which is clamped to the machine table by four bolts through the holes shown. Two steel feathers in the base fit into the T-slot of the machine. The base has a circular T-slot turned in it as shown, and has a square hole right through to insert three bolts for holding down the jig. The base has three mild-steel case-hardened bushes let in at *B C D* and a large recess for the spigot of the jig to keep it central when swung around.



JIG FOR FACING T-EXHAUST PIECES FOR AUTOMOBILES

The jig proper is shown at *E* with an exhaust pipe in position (seen on plan and partly on front view). This is made of cast iron and has three V's placed in it to receive the pipe which is held down by ordinary clamps. It will be noticed that one face is on an angle. To face this the locating pin is lifted from *B* and put into *C*. This gives the correct angle for this face. The other faces are square. One face is milled to the hardened stop *J*, then the three bolts are loosened and the table swung around in the direction shown and the locating pin placed in *C*. This face is then milled to the hardened stop *H*, the table swung further around and the pin placed in *D* again facing to the stop *J*. The slots across the stops are only to screw them in by. It will be noticed that locating bushes have no collars, but are made a good fit in the casting and these have not given any trouble. Before this jig was used, these T-pieces were a long, costly and awkward job, as the angle is most particular, like-

wise its position in relation to the other faces. It is intended to use the base on the same milling machine for various dividing jobs as they come along.

Grantham, England. T. A. J.

Adjustable Face Plate for Accurate Tool Work

The drawings illustrate a handy adjustable chucking plate. Fig. 1 shows the device assembled. This is a tool that is not costly, but in a tool room where subpress tools are made or on work of a similar character, it is worth its weight in gold. It not only assures perfect alinement of holes, but if used with a micrometer head graduated to read to ten thousandths of an inch, almost any degree of accuracy may be obtained.

Suppose we have a punch pad, stripper and die to produce as shown in Fig. 2: Lay out hole *A*, place the angle plate 0.375 inch below center, clamp the work, and bore the hole at *A*. Then move the micrometer holder to the back plate and adjust 0.369 inch to produce holes *C* and *D*, and so on. You can now harden your work and place the chucking plates on the grinder and repeat as before.

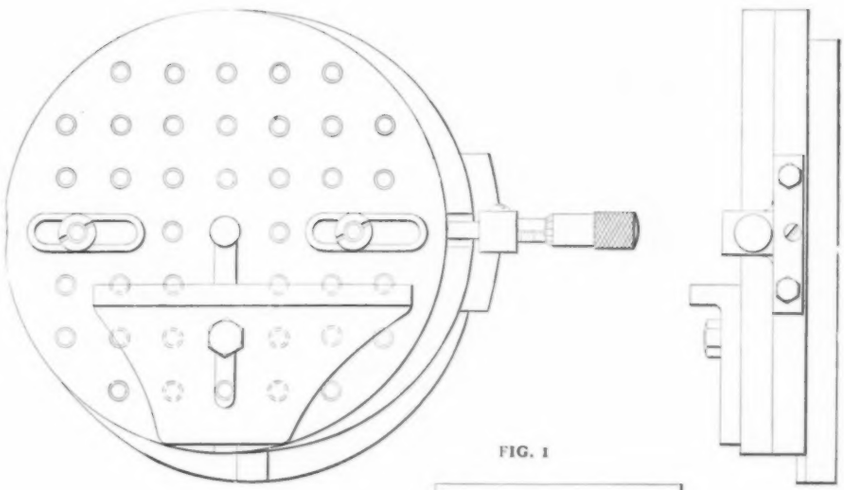


FIG. 1

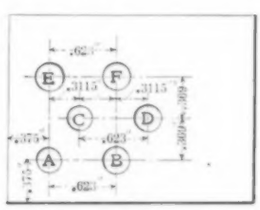


FIG. 2

ADJUSTABLE FACE PLATE FOR ACCURATE TOOL WORK

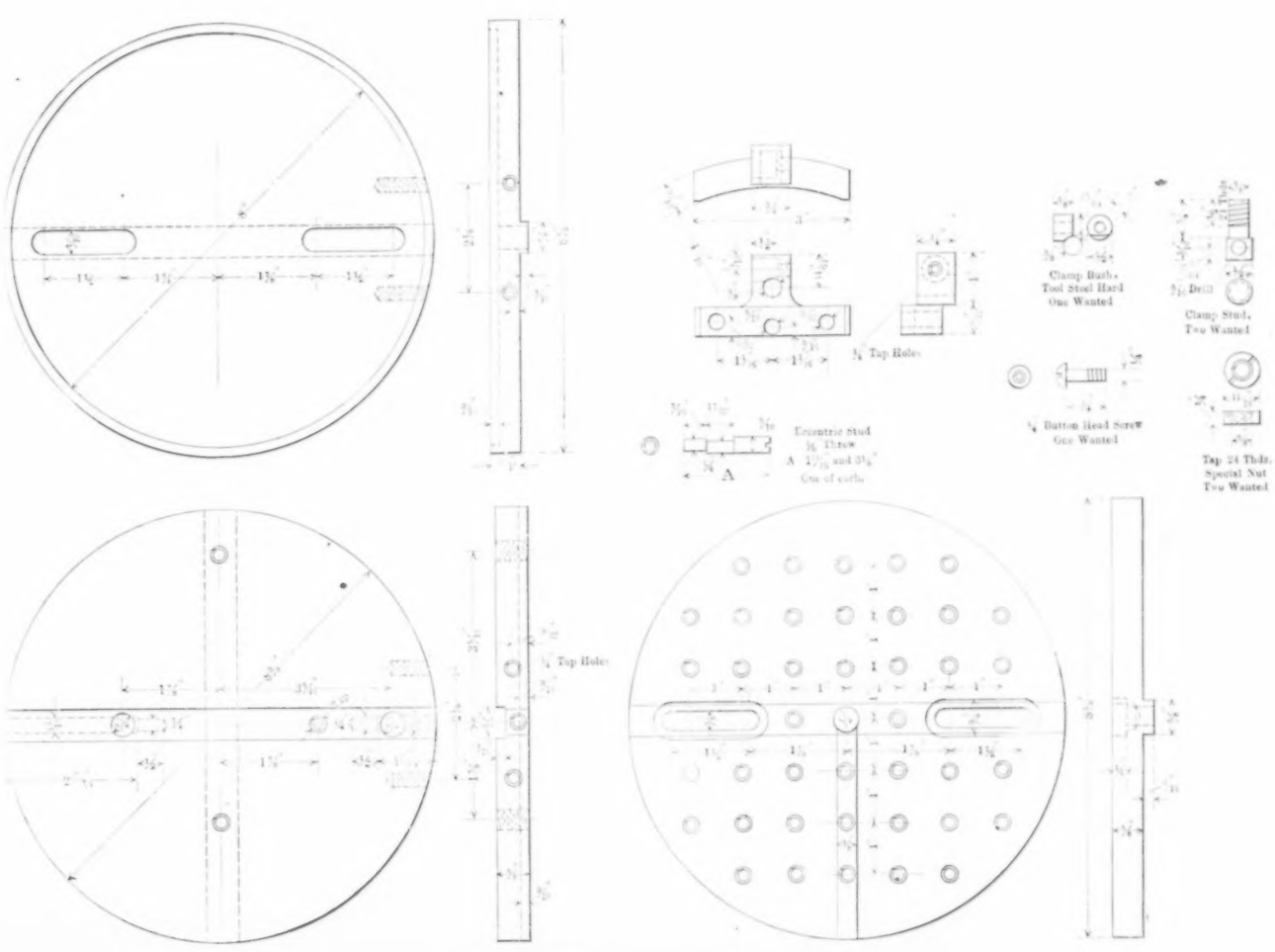

¼ Tap Holes
Clamp Bush. Tool Steel Hard One Wanted
Clamp Stud. Two Wanted
Eccentric Stud ⅛ Throw
Button Head Screw One Wanted
Tap 24 Thds. Special Nut Two Wanted

FIG. 3. DETAILS OF ADJUSTABLE FACE PLATE

Details of the plates are given in Fig. 3. We are using these plates every day and find they are far superior to the button system.

Chicago, Ill. A. C. CURRY.

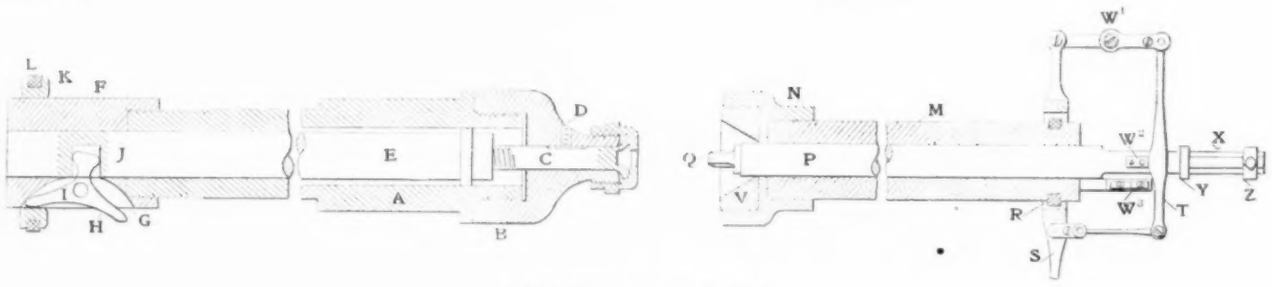
A Nut-finishing Machine

A brass works having a number of brass stripping-box nuts to finish, designed the machine shown.

An ordinary monitor lathe was used by taking off the turret head and using the regular spindle *A*. A nut chuck *B* is fitted to the spindle and has a thread less in length than the depth of the nut and a loose fit to it. The chuck is bored for the steel rod *C* and drilled and tapped for the headless screw *D* which prevents the rod from turning. The rod *C* is bored on the large end to allow the reamer to pass through the nut; the other end is fitted to the draw-in rod *E*. On the other end of the spindle is fitted the steel extension *J*; this has a slot milled at *G* and the piece *H*, of spring-tempered tool steel, swinging on the pin *I* is set in, a working fit. The end of this piece fits in a slot *J*, cut in the end of *E*. *K* is a steel ring bored a running fit on *F*, it is slotted and fitted with the split bronze *L*.

This fits in a lever as is usual on a monitor lathe. The use of this is to loosen the nut after it is formed. It is placed as shown, the nut is screwed on and formed with the usual under-cutting tool, when the lever is drawn toward the operator, drawing back the rod *C* and loosening the nut.

On a separate head is fitted the spindle *M*; this is fitted with the cast-iron chuck *N* holding the cast-iron piece *V* which is bored about 60 degrees with the mouth somewhat larger than the nut to be worked on.



A NUT-FINISHING MACHINE

The rod *P* has a reamer *Q*, the size of the hole in the nut, fitted on the end. This rod is a running fit in the spindle and well provided with means for lubricating. The other end of the spindle is grooved and fitted with a bronze split ring *R*. This is held in position by two taper-point screws in the lever *S*, which is in the form of a ring enveloping the spindle. Connected with the lever *S* by a link is the lever *T* having ball-and-socket joints, both being swung from the point *W*'. *W*² is a taper block screwed on to the rod *P*, the large end facing lever *T*. *W*³ is a taper adjustable block fitted to a forging fastened to the headstock.

The rod *P* has a key *N*, also a collar *Y* shrunk on it. *Z* is a forging fastened to the headstock; it serves as a stop and to prevent the rod *P* from rotating. On the under side of *P* is a coiled spring to keep it drawn back when released. The spindle *M* revolves in the same direction as *A* about one-third higher speed.

After the nut is formed and released the lever *S* is pulled forward, the headstock and adjustable piece *W*³ being set so that just as the reamer *Q* passes through the nut the piece *W*³ raises *T* allowing the rod *P* to draw back. The spindle is then brought forward until the taper at *P* engages the nut; this revolving at a higher speed will remove the nut.

With this arrangement a nut can be chucked, faced, reamed and removed without stopping or reversing the machine.

ELMER E. KLICK.

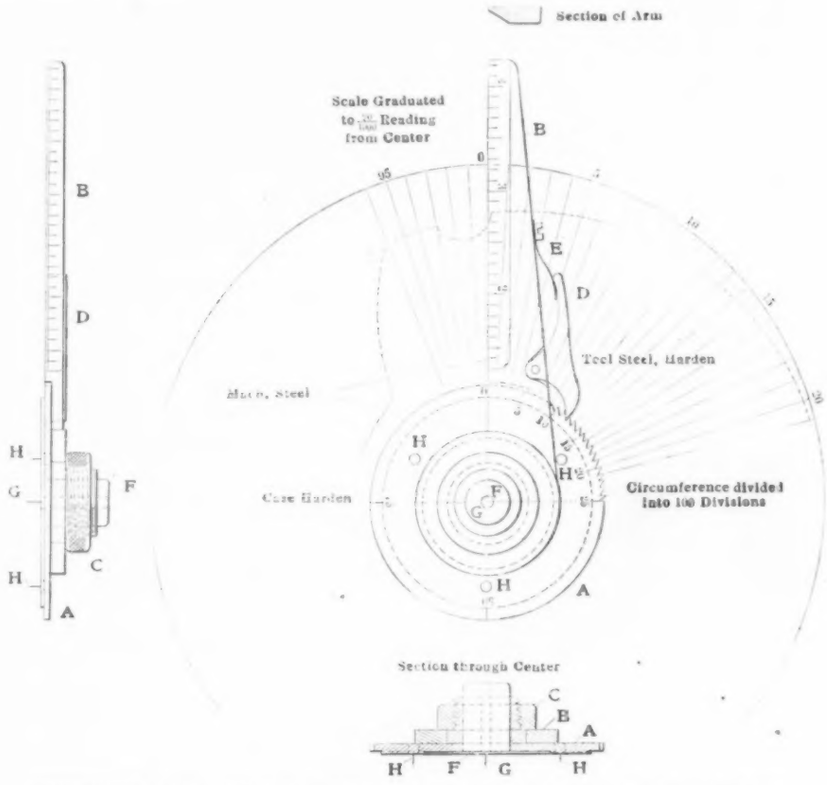
Miles City, Mont.

Instrument for Laying Out Screw Machine Cams

Some time ago I had a large number of cams to lay out for the Brown & Sharpe automatic screw machines and so devised the little instrument, of which I inclose a sketch, which proved very handy.

I figured my feeds, speeds, etc., and made the necessary table, drew my cam circles, and then placing this instrument in the center and pressing in the points firmly, I used the radial arm for laying out the rise and fall for the cam lobes and drew in the proper curves. It saved graduating the circles and picking up a scale every time I wanted to make a measurement. By having proper plugs made to fit the different sized holes in the cam blanks it could be used to scale off the right measurements on the blanks.

The main piece *A* is, of course, graduated in 100 divisions with a corresponding number of ratchet teeth. Upon this disk



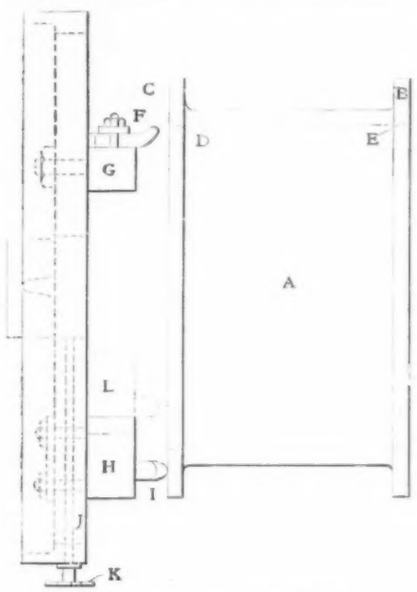
INSTRUMENT FOR LAYING OUT CAMS FOR BROWN & SHARPE AUTOMATIC SCREW MACHINES

is mounted the graduated arm *B* which swings under nurled nut *C*. The pawl *D* is held in contact with the teeth by spring *E*. The center plug *F* carries the needle point *G* which is slightly longer than the three points *H* by which the instrument is fixed in position.

Flint, Mich. Jos. H. Bamberg.

Boring and Facing Castings Too Large to Swing in the Lathe

A customer brought a number of castings *A* to the shop. These were to be faced at *B* and *C*, and bored about ½



THE TOOLS AND THE WORK

inch deep at *D* and *E*. At that time the largest lathe in the shop would swing only 16 inches. It was found that owing to projections (not shown) on the casting it could not be swung on the face plate.

Fig. 1 shows the first operation. The casting *A* was secured in a cheap jig fitted to the carriage of the lathe. The boring tool *F* was clamped to the block *G* which was secured to the face plate. The facing tool *I* is clamped to the sliding block *H*. *H* is actuated by the screw *J* and star wheel *K* which comes in contact with a trip clamped to the bed.

When the boring tool *F* is in operation the block *H* occupies the position *L*, shown in dotted lines. In this position the facing tool and block clear the inside of the cylinder as the carriage is moved forward to bore the cylinder end. When the block *H* was in position *L* the trip on the lathe bed was removed, of course.

After all the cylinders were bored and faced on one end an angle plate was mounted on the carriage. The facing tool was first put into commission to face a circle on the angle plate where the finished flange of the cylinder would bear. Then a ¼-inch plate was bolted to the angle plate approximately in the center of the circle.

The tool *I* was then removed and a bent one substituted. This was used to turn the ¼-inch plate to fit the bored end of the cylinder. This done, the tool *I* was put back in place, the cylinders bolted one at a time to the angle plate (being centered by the ¼-inch plate) and each one bored and faced on the unfinished end with the same tools which were used in the first operation.

New York. E. A. Dixie.

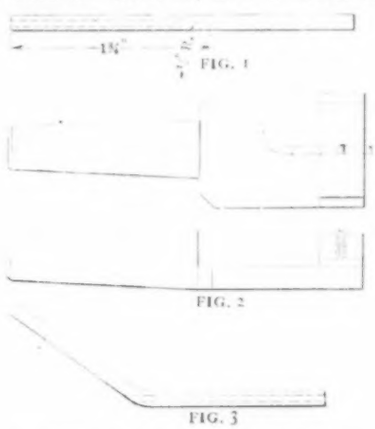
Drilling a Hole Around a Corner

Drilling a hole around a corner is a problem which has puzzled many machinists and has been given up by most of them as impossible.

While working in a job shop some time ago a job came in consisting of 100 pieces of ⅛-in. wire, 3 inches long, which was to be drilled as shown in Fig. 1.

The pieces were made in the following manner:

A pin, ⅞ inch in diameter, was made to bend the work on, after a sketch had



DRILLING A HOLE AROUND A CORNER

been made to determine the angle of the point where the hole entered or left the piece on the side. The piece was bent around this ⅞-inch pin, to an angle a little greater than was required. A holder like Fig. 2 was then made to hold the work in while being drilled. The drilling was done in a small lathe and after drilling the piece looked like Fig. 3.

The work was then heated and a piece of No. 50 Stubbs wire was inserted in the hole and the work was bent straight again.

Henry F. Hanson.

Worcester, Mass.

Wanted Information on Punch Press Work

In making various articles having sheet-metal parts, one die is used for punching out a part adapted to be used in several different combinations. Holes are punched in this part to suit all the combinations. I have heard that it was common to replace the metal punched out and crimp it in to temporarily close the holes, and when assembling the articles those holes one wants to use can be readily opened by knocking the metal out of them with a suitable tool. I would like to know if any of my fellow readers have done this, and if so, how they did it and when they first knew of it. I would also like to know of any other method which can be used for the same purpose.

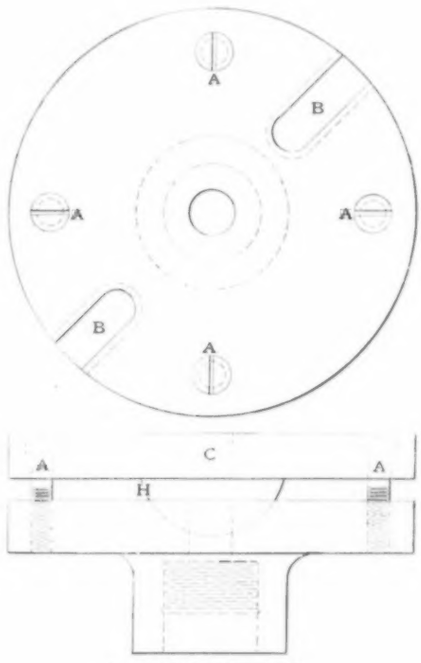
Washington, D. C. J. H. S.

A Handy Face Plate

The accompanying sketch shows a face plate which I have used on universal tool grinders for the internal grinding of long holes, or otherwise, when it was difficult to true the hole up on an ordinary face plate; also for grinding the outside diameter of work fastened to the face plate.

On the plate *D*, is a spherical boss *H*, which fits into the socket in the plate *E*. Plate *D* is held against plate *E* by four screws *A*. *B* and *B* are slots for the heads of the bolts in plate *D*.

For illustration, suppose we have a block strapped to the face plate with a three-quarter hole in it to be ground to size. If the end of the hole next to the face plate runs true while the opposite end runs out several thousandths, you



A HANDY FACE PLATE

can readily see that by adjusting the screws *A* you can make the hole run true at both ends.

Athol, Mass. A. Handy.

According to the American Iron and Steel Association the pig iron production of the United States in the first half of 1908 was 6,918,004 gross tons, against 12,303,317 tons in the last half of 1907 and 13,478,044 tons in the first half of 1907.

Discussion of the Previous Question

Letters from Our Readers Showing How Many Men of Many Minds Look upon Various Subjects Opened up in Previous Numbers

WE PAY FOR THESE ALSO

Balancing Grinding Wheels

Any grinding wheel as supplied by a manufacturer is, or should be, balanced before it leaves his factory, but it would seem to be impossible for him to guarantee it to maintain that condition indefinitely. We have had wheels of varying diameters, which, when new, gave every satisfaction in this respect, but when worn they have become unbalanced; this is probably because a grinding wheel is made up of various materials and, therefore, hardly likely to be always homogeneous. The heavier or denser portion of the wheel may be at some part of its outer diameter, and when this is worn down the wheel may cause such vibration in the machine as to make nice work impossible. Many people unconsciously suffer from the trouble of an unbalanced wheel and attribute the defective work thus produced to the maker or designer of the machine. A wheel running unbalanced may possibly be turned true at one particular speed, but the slightest variation from this speed will cause it to run eccentric; then we get those spiral chatter marks that are almost maddening when they appear as the final finishing chip is to be taken.

If the work is of a heavy character and unsupported by steady rests these chatter marks are certain to appear when an unbalanced wheel is used. The wheel will cause the whole machine to vibrate with some violence, and as the work is suspended on the centers its vibration will not be in unison with the wheel and machine, but rather in a vertical direction. Heated bearings and the extra wear and tear from this cause will be readily understood. I am now of the opinion that a wheel-balancing arrangement is a very necessary part of the equipment of a grinding plant, in fact it seems just as necessary as a diamond and micrometers. For our own purposes we have adopted the following method of balancing which may be of interest to readers of the AMERICAN MACHINIST. It has the merit of simplicity and I might suggest that grinding-machine makers could provide similar conveniences in the finishing of their machines. We have several Norton plain grinders and an explanation of our method of wheel balancing for this machine will suffice for all. On the Norton plain grinder the wheel is held by a cast-iron flanged bushing with a conical hole to fit the machine spindle, as shown in Fig. 1. I should say here that we never remove a wheel from this bushing until it is quite worn down; there is always a little play in the bore of the wheel and changing its position after balancing may disturb the equilibrium. Another important reason is that the large amount of grit to be removed in truing the wheel causes an excessive wear of the diamond tool. We bore 10 holes in the flange as shown, making them somewhat tapering. These holes are for the balance weights and are tapered to prevent the weights flying out when the wheel is revolving.

When we find any evidence that the wheel is unbalanced, we loosen it from

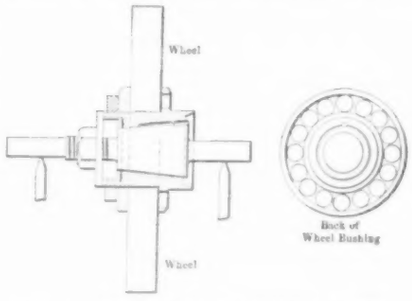


FIG. 1. METHOD OF BALANCING EMERY WHEELS

its spindle along with the bushing and place it on an arbor which is turned to fit. It is then tested by placing it on the two leveled and trued straight-edges as shown; the heavy side, of course, rolls to the bottom and on the opposite side we insert in the holes leaden disks of a sufficient weight to compensate for the irregularity. These leaden disks are cast to fit the diameter of the holes and are 1/16 inch thick. When a sufficient number of the disks are in position they are spread with a punch and hammer to fill the holes and prevent them from flying out. On our Brown & Sharpe universal machines we do the same; that is, we drill the wheel holding washer and insert leaden disks. In this machine the wheel spindle is easily detachable, so we put the whole spindle with its wheel and fittings on the straight-edges for testing. We have found this wheel balancing to be of great advantage in improving the quality of work and it takes but a few minutes to do.

If a grinding machine runs steadily when the wheel is removed it is safe to assume that the wheel is unbalanced; that is, if the whole machine vibrates when the wheel is in place. These vibrations will be most in evidence just before the wheel reaches its maximum speed. If no balancing straightedges are available the following method may be adopted: True up the wheel with a diamond tool while it is revolving at a reduced speed and then smear the wheel face with chalk or whiting; after this has been done run the wheel at full speed and bring a pencil carefully against the wheel face. The heavier side of the wheel will be marked and compensating weights may be inserted on the opposite side; repeat the process until the vibration ceases.

GRINDING FORMED CUTTERS WITH BEVELED WHEELS

I have to thank the AMERICAN MACHINIST for many valuable pointers during several years' perusal of its pages. One is the grinding of gear and formed cutters with the beveled side of a saucer wheel. When you come to consider it, it resolves itself into being the only proper way to generate the least possible amount of heat.

A correspondent, on page 775, Volume 31, Part 1, evidently has objections to the method and speaks of sinking the wheel or cutter downward from the top of the tooth; this is only possible with gear or narrow-form cutters on account of the radius of the wheel. He also says that he has to be very careful to get a straight-faced tooth and I should imagine from this that he trues his wheel by hand. I can recommend to his notice the little device shown in Fig. 2 for truing these wheels. It is one that I use for many other purposes. It is cheaply made and will insure a clean, true cutting face on the wheel; the main thing is to have a good sharp diamond so that it will actually "cut" and not rub. Referring to Fig. 2, *A* is a piece of cast iron machined to fit the diamond holder pillar and slotted to admit a holding-down bolt. It will be seen that the pillar carrying the diamond holder can be swung over to any angle and the diamond is fed over the wheel-face by hand. A locking screw is provided for locking the diamond in position when this is desirable.

TRUING WHEELS ON THE SURFACE GRINDER

I think it is a great mistake to attempt to true a wheel by hand if there is any mechanical means available; the practice is responsible for many lost diamonds. Again the diamond should be fixed in a position relative with the work in hand and fed over the wheel-face in the plane

of its movement or side feed. Many people true the wheel of a surface grinder as shown at *A*, Fig. 3. If the spindle should not be quite parallel with the cross-slide the wheel does not have a face parallel with the work. This, of course, causes unsightly feed lines to show up on the ground surface; then again the truing fixture must be affixed and removed at each truing operation. I submit the method at *B* as being a far better one as it insures accuracy and gives much less trouble. The diamond is held in a small plate which is drilled for a holding-down bolt; whatever the piece of work to be ground, the diamond is mounted on packings to a hight just below that of the work surface at the back of the work. When it is necessary to true the wheel, the table is run forward until the diamond is just below the wheel center; the wheel may be then fed down to the diamond point and traversed across it.

Injuring Tools in Grinding

On page 774, Volume 31, Part 1, a correspondent complains of the injury of tools by grinding with an emery wheel. The reading of this complaint brought to my mind a similar case. Some six months ago I visited a factory where they had had this trouble and my attention was called to the fact by a new American grinding stand standing with the belt off and a general neglected appearance. On inquiry I was told that it had been dis-

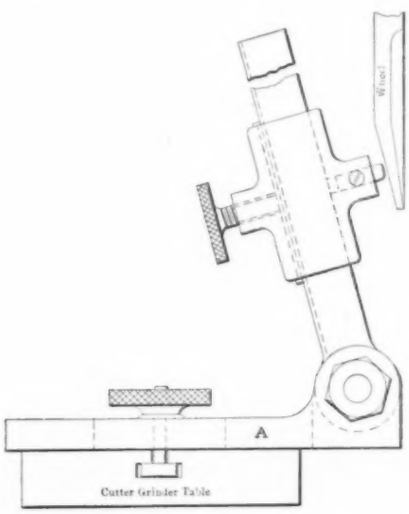


FIG. 2. WHEEL-TRUING DEVICE

carded because it softened most of the tools which had been ground on it and that they had gone back to the grindstone. The grade ticket was on the wheel and I noticed that it was a Norton wheel 36 P; investigation showed that it had a surface of 5400 feet per minute when in use. I advised that they procure a 20 L alundum wheel and reduce the speed to about 4000 feet. Since reading the complaint mentioned I have inquired as to the result of the change. The reply is that the 20 L wheel running at 3800 feet per minute is giving every satisfaction. This prejudice in favor of grindstones is a somewhat unreasonable one; the only thing in their favor is that their slower surface speed makes them cut cooler than the average wheel supplied with a grinding stand. If it were possible or safe to run them at the same speed as an emery wheel they would, no doubt, draw the temper just the same.

These cool-cutting properties can be

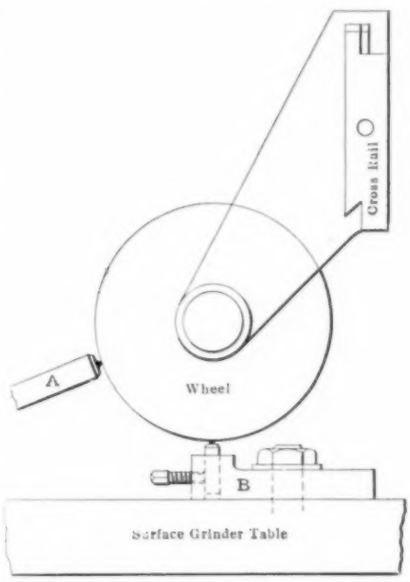


FIG. 3. RIGHT AND WRONG METHODS OF TRUING SURFACE-GRINDER WHEELS

obtained from an emery wheel if a proper selection be made and if some judgment be exercised as to their speed. The wheels usually supplied with grinding stands are far too hard, although those that supply them are not altogether to blame. People will insist on having wheels which shall last a long time and which shall to some extent be fool-proof in this respect. The same remarks apply to the furnishings of most cutter grinders. The use of water in cutter grinding is of an undoubted advantage, but the design of a really efficient universal machine would seem to be very difficult. The two or three which I have seen throw the water about so much in some of the operations that they had to be isolated. In the absence of water the only alternative is to use the soft-bonded wheels, and to enable them the longer to maintain their sizing power it is better to choose a fine grit. I find 60 J alundum the best for any shape of wheel for cutter grinding.

Does Temperature Affect Wheel Balance?

Returning to the question of the balancing of grinding wheels, it would be interesting to know from some of our wheelmakers if temperature or atmospheric conditions can affect the equilibrium of a wheel. Probably others besides myself can show sufficient reason for imagining this may be so. I have had wheels from firms whose reputations are beyond question, which were guaranteed to be balanced and were stamped on the leaden counterweight to that effect. Yet these wheels in their unused condition have sometimes been considerably out of balance. As their constituent materials are known only to the wheelmaker, he would seem to be the only one that can tell us if the by-period between balancing and using will, or is likely, to cause change.

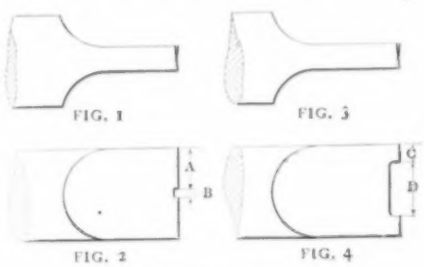
A. B. Schliefer.

London, England.

Keyway Cutters

Your correspondent, T. M. Lowthian, on page 96, gives his experiences, and a few hints, on keyway cutting, in the vertical spindle machine, or slot drill.

He is correct when he says this method is slow, and consequently expensive, due to having to travel over the length of keyway so many times, with a very light cut. About two years ago I started experimenting with a cutter similar to the one he shows in Figs. 1 and 2, which is practically an ordinary end mill, cutting the full depth of keyway at once. When cutting open-ended keyways by this method, we cut them in 12 minutes each, although it formerly took us 1¼ hours each, but the quality of work turned out was not nearly so good; their edges were very jagged and rough, and also wider than the diameter of cutter, so that we had to abandon this method, as our inspection department would not pass the work. The uneven edges of the keyways were due to the wobble of the cutter, under the great strain imposed on it, and the machine spindle was not strong enough to keep it firmly up to its work. With a very strong and powerful ma-



THE KEYWAY CUTTERS

chine, having the spindle properly adjusted, we might have cured the evils, but the tools not being of recent design, we went back to the old and slower methods, and turned out a better quality of work.

A very common type of keyway cutter, or slot drill, used in England, is shown at Figs. 1 to 4. It is cheap to make, and when properly ground is very efficient. I have seen thousands of keyways, and also cotter holes, up to 2 inches wide and 4 inches deep, cut by them. It is simply

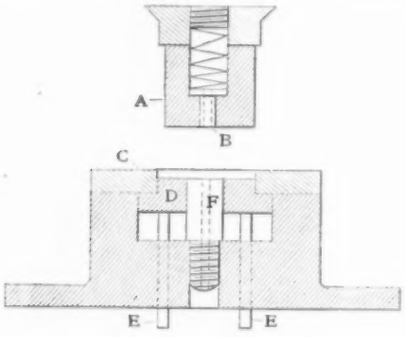
turned to the correct diameter, and then milled flat on the sides as shown, for a distance according to the size of the cutter. One of the great faults of this cutter is that it is very often not made correctly at the cutting edge, as shown in Fig. 2, the cutting edge *A* being left far too wide, with only a narrow space cut or filed across the center *B*. This makes it very hard work to feed the cutter down, when cutting keyways with blind ends; in fact, it is practically impossible to put the feed on with large size cutters when they are made like this. These cutters should have a good wide space ground out at the center, as shown at Fig. 4, marked *D*, which makes the cutting edge *C* very much narrower, and consequently much easier to feed down. In addition to that, the chips cannot crowd under the cutting edges, and thereby break the cutter, as there is plenty of clearance when made as shown.

J. H. Brooke.

Coventry, England.

Blanking and Drawing Shells at One Stroke of a Single Acting Power Press

The article, on page 346, by W. J. Murphy, has attracted my attention, and I write for further information. I have had considerable experience in shell work, and would state that I have never seen a set of tools, such as the ones shown, work with any degree of satisfac-



BLANKING AND DRAWING DIE

tion. The trouble is shells which are wrinkled very badly.

Another point in the design shown which is not plain to me, is the manner in which Mr. Murphy would strip his work from the drawing die in the blanking punch, should a shell happen to stick there. This is not at all improbable. I have had work of a similar nature to do and I accomplished it by use of a compression spring and also made use of a spring stripper in the drawing or forming die.

Tools made to the sketch shown will give a smooth shell. Here *A* is the blanking die with the drawing die at *B* with a spring stripper in the drawing die. The pin has an air hole through it to prevent suction. The blanking die is *C*; *D* is the planishing surface which holds the blank flat and prevents wrinkling. The rods *E* are connected to either a spring or a rubber compression which is adjustable to suit the work. At *F* is the drawing punch which is shown shouldered to have a seat so that the threads do not have to take any strain. The sleeve *D* also acts as a stripper for the punch *F*, which has a hole through it to release the air.

Danbury, Conn. M. L. Marston.

Tapping Attachment for Automatic

At page 317 there is an article by C. M. in which there is some confusion in regards to right- and left-hand.

In the first place let us look at the diagrams, Figs. 1 and 2. Fig. 1 shows

FIG. 1

FIG. 2

DIRECTION OF ROTATION OF A DRILL AND OF AN ACME AUTOMATIC

the direction that a lathe or a drill runs which, as they tell us in mechanics, is counter-clockwise or left-handed. Fig. 2 shows the direction that the Acme automatic runs, clockwise or right-handed, but nine out of ten shop men would say, without thinking, that it runs left-handed because it runs in the opposite direction to a lathe.

C. M. states that the Acme does not run well left-handed, but he also says that when the spindles run right-handed the cylinder does not come back into place perfectly; so how are you going to run it? The way that paragraph should have read is: "The Acme does not run well left-handed on account of the cylinder indexing mechanism." No mention should have been made of running right-handed because that is the way it is built to run.

Now in regards to how he goes about to cut the thread without stopping the spindle; the first instructions are to set the machine so that it will run left-handed. Now, why run it that way when he says it doesn't run well? I know it doesn't myself because it was never built to run that way. Then he says to run the die right-hand one-third faster than the work. Then if the work were running 300 revolutions per minute, which is the speed we are running our 1⅜-inch Acme, the die would be going onto the work at the rate of 400 revolutions per minute, which would be traveling some for a ½-inch die. He then goes on to say that he stops the die and it runs off because the work is running left-handed. Now, a very little thought will show that if you hold the die, and the work turns left-handed, the die will keep right on feeding onto the work instead of coming off. I understand, of course, that he is talking about a right-hand die for if it were a left-hand die it wouldn't start on at all with the work running left-handed and the die running right-handed.

Lowell, Mass. Paul W. Abbott.

Welding Shafting

On page 201, an article entitled "Welding a Shaft that Would not Weld" attracted my attention. After reading the article I came to the conclusion that the principal difficulty arose from trying to butt-weld a shaft made from steel.

Had the shaft been of wrought iron it could have successfully been butt-welded and finished as far as blacksmith work goes in about 50 per cent. less time than it would have taken to scarf-weld it. Steel when it comes to butt-welding acts entirely different from wrought iron; it is harder, the grain is more dense and it will not stand the same amount of heat, with the result that when a sledge hammer or a ram is used upon the end of the shaft to effect a weld after it has been heated, the vibration caused by the blow shakes the pieces apart. I have had considerable experience on this class of work, scarcely

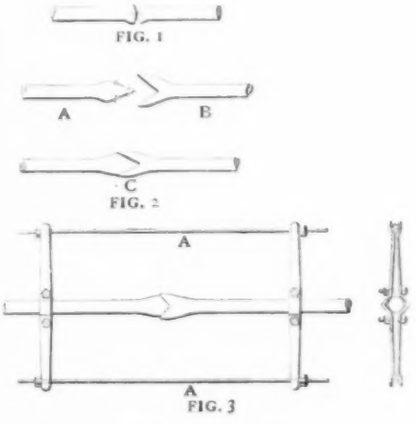


FIG. 1

FIG. 2

FIG. 3

WELDING SHAFTING

a day and never a week passing in the last four years without more or less shafting having to be welded. The average lengths being from 20 to 80 feet, and diameters from 2¼ to 3¾ inches, it might be interesting to some of the readers of the American Machinist to know how this kind of work is done.

Wrought-iron shafting, if the diameter exceeds 1½ inches is prepared as shown in Fig. 1. The ends of the pieces are slightly upset, crowning in the center. A small hole is then punched about ½ inch deep as near the center of the shaft as possible. A dowel pin is placed in the holes to keep the pieces in alinement. They are

then placed on the forge and heated to a welding temperature. A sledge hammer, or if the work is of large dimensions, a ram is used on one end to effect a weld. While it is still in the fire and when the pieces have been fairly stuck together, the shaft should be turned in the fire until welding is complete, which will insure all sides being as nearly as possible the same temperature. Welding commences at the center, all slag or dirt being forced out as it is proceeded with. If the shaft is removed from the forge, and the portion immediately around the weld is worked down to the same diameter as the rest of the shaft, it is hard to tell the exact spot where the pieces are joined. Steel shafting has to be welded differently for reasons already stated, the pieces up to a certain size usually being prepared as shown, Fig. 2. The ends are upset by means of a ram swung horizontally until they are large enough to allow for waste in heating and hammering. One piece is scarfed as shown at *A* a few burs being raised on each side of the scarf to keep the other portion which is split as shown at *B* in position when it is closed in as shown at *C*. The pieces are then heated and welding carried out in the usual manner. When the diameter of shafting exceeds 3 inches it should be prepared for welding as shown in Fig. 3; the principle is the same as Fig. 2, only that the scarfs are shorter, usually about the angle of 90 degrees. No burs are raised on the sides of the scarf that fits in the split portion, they being clamped together to keep them in position as shown. They are then placed on the forge, heated and welded together in the same manner as wrought-iron shafting is butt-welded. When the pieces are fairly united the tie rods *A* are removed from the clamps which allows of the work being turned in the fire; when all sides have been brought as nearly as possible to the same heat, it is then removed from the forge and welding is completed in the usual manner at the steam hammer, using the clamps which are still left in position as levers to handle and turn it as the operation is proceeded with. Poor welds may sometimes be made, but shafting that will not weld has not yet been met with by me.

Plainfield, N. J. JAMES CRAN.

Preserving the American Machinist

Referring to the question of preserving the issues of the AMERICAN MACHINIST, I thoroughly agree with Mr. Hall, on page 317, when he says that a technical paper that is worth taking, is worth keeping. I have been a subscriber to the AMERICAN MACHINIST (and one or two other technical journals) for a number of years, and for a long time I was searching for a reliable method of preserving the files. At last I decided on the method described below, as to get them bound by a bookbinder was considered to be too expensive.

SUBJECT Lathe Work CARD NO. 114

L. C. BROOKS, B. S.

TITLE	AUTHOR	BOOK OR JOURNAL	VOL.	PAGE
A spherical turning rig	F. E. Fick	A. M.	31.2	132

THE INDEX CARD

I investigated the product of various concerns who manufacture loose-leaf binders, and decided to use a black cloth, adjustable back binder made by J. H. Gerlack, of College Point, N. Y. The backs are adjustable to a thickness of 4 inches (the proper thickness for six months' issues of the AMERICAN MACHINIST) with name printed on the front. These cost 75 cents each when ordered in small quantities. After removing the advertising pages, a shoemaker's awl is used to punch two holes in the back margin of the reading pages, so that they will fit over the studs of the binder. The time for the entire job of binding the volume of 26 issues is about one and one-half hours. I adopted the same scheme as Mr. Hall regarding advertisements, viz., bind one complete issue (ads and reading matter) in each volume, and such extra pages as I desire at the back, there usually being one special issue in each six months, which gives a good representation of current advertising which, taken together over a few years, make an interesting technical history. The same result may be accomplished by binding together with a strong fish line, without the binder, but the neat appearance of the binder fully justifies the small expense. These bound volumes are kept in a plain, sectional book case, which is not expensive.

For index, I bind in the front of the volume the regular index published by the AMERICAN MACHINIST, and I also have a small card index, subdivided into special subjects with cards like sample inclosed, on which the more important articles are entered as the journal is received each week. The column marked "Vol." has 31.2, the 2 signifying Part 2.

After five years' use I have found the above scheme very satisfactory for ready reference, and many times have been able to assist my friends who desired to look up some special subject, but did not have back numbers of the journal. With a little experience the volumes may be made very neat in appearance, and the four book-case sections which I now have filled form a very valuable technical library.

Boston, Mass. L. C. BROOKS.

The Friction Steering Clutch

On page 334 of the AMERICAN MACHINIST is an article by H. D. Chapman, entitled "Steering Clutch for Automobiles."

This device is and has been used by the Navy Department for the last five years, as a friction hand-wheel clutch on the sights for the guns of the navy and it works to good advantage.

For automobile work, in order for the friction pawls to grip the cup, there must be some play or lost motion in the handle, and this can be seen in the assembled drawing. The pawls *G H I J*, in gripping the cup, have a tendency to open up, which raises the release bar *O*, which in turn touches the pins *N*. If there were no lost motion the pawls would slip in the cup.

This lost motion or play in the handle is, to any one familiar with the automobile, very dangerous, and for this reason alone the device, while of use on sights, is of no use on automobiles.

Again, even if the play in the handle could be overlooked, the pins *N* would shear off or bend when any great strain was put on them, as is often the case.

WILSON GREGORY.

Baltimore, Md.

The material left at Panama by the French is being utilized in different ways. Over a million pounds (500 tons) of old rails were picked up along the line of the canal recently and have been stored for use in reinforcing concrete in the locks should it be necessary.

AMERICAN MACHINIST

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Oct. 1..... 33,000
Oct. 8..... 18,750

This paper reaches 33,000 *separate readers each month and* 18,750 *each week.*

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

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Simultaneous Publication

Last week our department of New Tools and Machine Shop Appliances filled 31 columns. This week it fills four. This condition is the outgrowth of the common practice among manufacturers of sending us material for articles of this kind with a request that publication be withheld until the first issue of the succeeding month.

Why should weekly publications be asked to discard the advantage of such publication and hold up descriptive articles of new machines to suit the convenience of the monthlies? This practice has grown of late until it has become a simple nuisance, the result being that our issue for the first of each month is crowded with articles of this kind to the exclusion of others which we always have waiting for publication, while the advantage of earlier publication to readers, to manufacturers and to ourselves is thrown away. Meanwhile the department of New Tools goes dry in other issues and the space is filled with articles that do not belong there.

The matter is as vital to other weekly publications as it is to ourselves, and we trust that they will look at it as we do. There is not another field of journalism in which this practice would be tolerated for a moment, and yet, through editorial courtesy gone to seed, the entire weekly mechanical press of the country has practically abandoned weekly publication so far as articles of this kind go.

We, with other weeklies, have shown an excess of good nature for which there is no warrant and this, for our part, we intend to do no longer. We shall forthwith resume weekly publication of our department of New Tools and Machine Shop Appliances.

Certain of our weekly contemporaries, in which the news feature is more prominent than in our paper, possess advantages by which they can occasionally anticipate us by a few days. To this advantage they are entitled, just as we are all entitled to the advantage that goes with weekly publication. It is as absurd for them to wait for us as it is for us to wait for others and we request them to do it no longer.

The AMERICAN MACHINIST makes its own engravings and writes its own descriptions. It prints these articles in its weekly, monthly and European editions, and sends a special reprint, in advance of the paper, to every foreign dealer in machine tools.

This service is of great value to the manufacturer and costs him nothing. It is published primarily to interest the 33,000 readers of the paper who pay to receive this news of their business.

We must insist that we be allowed to use our best judgment as to how, when and how much space shall be given to the description of each machine or device. Many years of experience has taught us to look at the matter from every viewpoint.

We must interest and satisfy the reader, give him the *news* about the machine, not the claims of the builders alone.

We will not, hereafter, enter into agreements for simultaneous publication with any monthly publication.

It is our intention to give not to exceed five pages in any one issue to this department—not one page in one issue and a dozen in another.

Hereafter we shall get these descriptions into the paper as soon as possible after receipt. We cannot always fix a date when they will appear.

But this we promise, the description will be adequate, specially prepared for our readers and made interesting to them, and will reach more people responsible for results in machine-making plants the world over than can be had by simultaneous publication in any and all other publications.

The Invention of Reinforced Concrete

The origin of many great inventions is clouded in mystery while that of others involved such a slow process of development to which many minds contributed that it is usually impossible to give to any individual the credit for their original conception.

To this general rule, reinforced-concrete construction for buildings appears to be an exception. Professor Sweet has called our attention to a remarkable paper by W. E. Ward, entitled, "Béton in Combination with Iron as a Building Material," which was published in the "Transactions of The American Society of Mechanical Engineers for 1883." This paper describes a dwelling house built by the author of the paper at Port Chester, N. Y., and still standing, we believe, in which all of the essentials of re-inforced concrete work as carried on today made their appearance.

It appears from the paper that the conception of this system of construction dates from 1867, actual experiments upon the strength of the combination of materials having been made in 1871 and 1872. The house had been inhabited six years when the paper was published, carrying its date of construction back to 1877.

It is true that some slight amount of experimental work and even light construction work had been done before this, but nothing, we believe, that could be looked upon as a real adoption of the system in a structure of any moment and certainly nothing to be compared with this.

In one respect only is the construction different from that now followed. In building the house the beams were made

first, the floor slabs being molded in position after the beams had hardened, the two being thus not integral. The steel member of the beams was a small I-beam located at the bottom, as it should be, while the re-inforcing members of the slabs were iron rods arranged precisely as in present-day construction. The house was in no sense half-hearted in construction, the paper stating that "all the closets, stairs, balconies and porticos with their supporting columns were molded from the same material. The only wood in the whole structure was in window sashes and doors with their frames, mop-boards and stair-rails, thus excluding everything of a combustible nature from the main construction." Moreover, the house was by no means a small one, as is evidenced from the picture of it which the paper contains and from the statement that "By this process over 13,000 square feet of flooring and roofing were constructed to fill the requirements of the building."

It is seldom indeed that a new invention makes its appearance complete with nothing to add and nothing to subtract as it did in this case. It is perfectly obvious from the paper that the author had the advantages of the system in his mind precisely as they are held by constructors today, while his preliminary experiments were all that were required to permit intelligent design of the building from an engineering standpoint. Those readers who have this volume within access can do no better than refer to the paper as the original publication of a great invention.

Wages and Purchase Power

It is interesting to note the comparisons made in a very exhaustive statistical report made by the Department of Commerce and Labor concerning the wages and their relative purchasing power for the period of 1890 to 1897 in the leading wage-working occupations of 4169 establishments in the principal manufacturing and mechanical industries in the United States.

In the year 1907 the average wages per hour in the principal manufacturing and mechanical industries of the country were 3.7 per cent. higher than in 1906, the regular hours of labor were 0.4 per cent. lower than in 1906 and the number of employees in the establishments investigated was 1 per cent. greater than in the year previous.

The variation in the purchasing power of wages was measured by using the retail prices of food, the expenditures for which constitute nearly half of the expenditures for all purposes in a workingman's family, and on this basis the retail prices of food were 4.2 per cent. higher in 1907 than in 1906. As the advance in retail prices from 1906 to 1907 was greater than the advance in wages per hour, the purchasing power of an hour's wages, as measured by food, was slightly less in 1907 than in 1906, the decrease being one-half of one per cent.

William J. D. Keuffel

William J. D. Keuffel, head of the firm of Keuffel & Esser, manufacturers of drawing and surveying instruments, died at his home, No. 512 Hudson street, Hoboken, N. J., October 1.

Mr. Keuffel was born in Germany in 1838 and came to this country in 1866. In 1867, with his partner, Herman Esser, he founded the firm of Keuffel & Esser. The firm began manufacturing in a small way in 1878, turning out such draftsmen's requisites as are made of wood, T-squares, scales, etc.

In 1880 the firm began the manufacture of surveyors' instruments in a new factory in Hoboken. Since then the business has grown till now the factory has five and one-half acres of floor space..

WILLIAM J. D. KEUFFEL

He was interested in many German-American societies and gave both time and money liberally to charities. He leaves a widow and four children.

New Publications

THE PLANE TABLE AND ITS USE IN SURVEYING. By W. H. Lovell. 47 4¾x7¼-inch pages, 8 illustrations in the text, indexed. McGraw Publishing Company, New York City. Price $1 net.

The author, who is a topographer with the United States Geological Survey, points out that the plane table is a most useful surveying instrument that is very little known in the United States, although it is used extensively in Germany, Austria and Italy. Its principal use in this country today is by the United States Government for both coast and geological surveys. A concise and clear description of the instrument is given and its necessary adjustments, and an outline of the general problems arising in its use and their solutions.

THE MECHANICAL PROPERTIES OF SHELBY SEAMLESS STEEL TUBING. By Reid T. Stewart. 98 4½x7-inch pages, with numerous illustrations and tables. The National Tube Company, Pittsburg, Penn.

Among the noteworthy high-class handbooks which have been put out by various American manufacturers, we know of none that ranks higher than the pamphlet under notice. The author's paper on the collapsing strength of tubes attracted wide and deserved attention when presented before the American Society of Mechanical Engineers, and the present pamphlet contains the working results of the investigation reported in that paper. The pamphlet is, however, much more than a reprint of the author's paper, as it includes a large amount of information in tabular form regarding the various structural uses of tubing, most of which are new and not to be found in engineering handbooks. The author and publishers have done a distinct service to both mechanical and civil engineers, in the preparation of the pamphlet, and there will, we have no doubt, be a large demand for it.

ELECTRICAL CONTRACTING. By Louis J. Auerbacher. 150 5¼x8½-inch pages, 225 illustrations, indexed. McGraw Publishing Company, New York City. Price, $2.

The author's preface states that this work was written for the wiremen and contractor, but it will prove to be of value, as well, to electricians in manufacturing and other plants where new installation work and repairs are carried on. This does not imply that the work does not live up to its title, but rather that the work is broader than its title. It is as valuable a book in its class as we have ever seen. It is written in a clear, concise, explanatory style, and shows that its author thoroughly understands the practical side of the work of the wireman and electrical contractor and has written from his own experience. There are many illustrations and diagrams of wiring methods and half-tones showing standard fittings. These devices and methods are only such as are approved by the underwriters. The first chapter discusses a shop system for electrical contractors and is especially timely. Too often such a shop has no system whatever, to its own hurt. The system as described is free from red tape and can be narrowed or broadened to meet requirements. Standard forms are shown in profusion. The second chapter treats of estimating, and the following five chapters with methods of wiring. Chapter eight is given up to the wiring of residences; chapters nine and ten take up the installation of motors, small generators and switchboards; chapter 11 treats of electric signals, and chapter 12 of special lighting and heating devices.

New Tools and Machine Shop Appliances

Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost

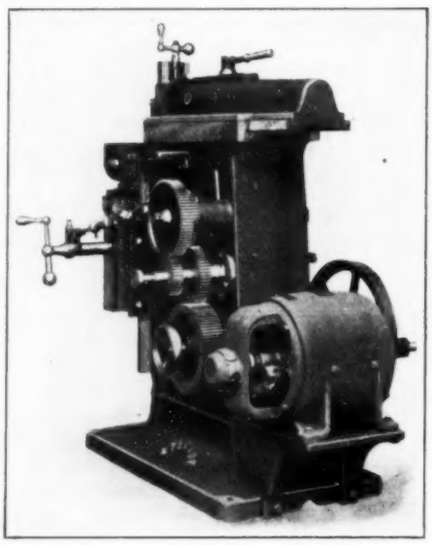
THE LATEST INFORMATION

Automatic Valve Grinder

Those who have ever watched a cock grinder at work have noticed the somewhat peculiar twist and the frequent raising of the body away from the plug, and although this may have appeared foolish at times, there was no denying that he did a good job.

Makers of machines for this work have endeavored to obtain a similar motion, and in the machine shown this is secured in each of the four, six or eight spindles used. The plug is held loosely in the upper end of the spindle, the body is placed over it and prevented from turning by the upright studs. The bodies are lifted away from the plug by the cam and roller above the driving gears, as shown in the details of Fig. 2. In fact the whole operation is very plain and requires very little explanation. When at work this gives a grinding motion that practically imitates hand work and in addition, shows a large saving of time.

These machines are made by the Wm. J. Oliver Manufacturing Company, Knoxville, Tenn., and are being used by several of the larger railroads of this country.



MOTOR-DRIVEN STEPTOE SHAPER

Motor-driven Steptoe Shaper

The motor stand and drive of this shaper has been designed to economize space, being built specially for use on a revenue cutter and the arrangement shown comes within the space taken by the ram on the extreme back stroke.

The shaper is of the single-geared crank type with a 2¼-horsepower General Electric motor, which runs from 750 to 1500 revolutions per minute. This drives the gears, shown through a rawhide pinion, with a ratio of 8 to 1, the shaft for

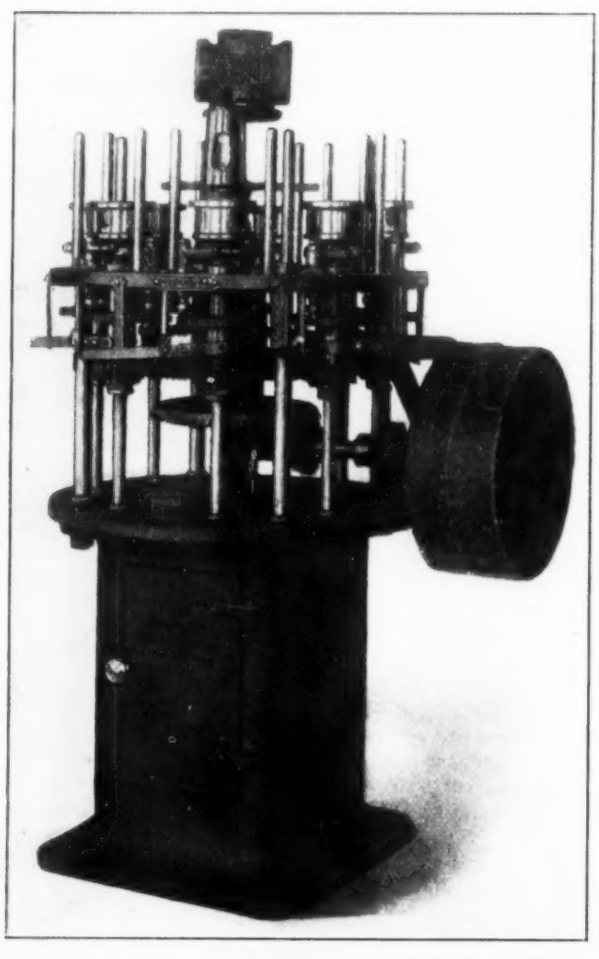


FIG. 1. AN 8-SPINDLE COCK GRINDER

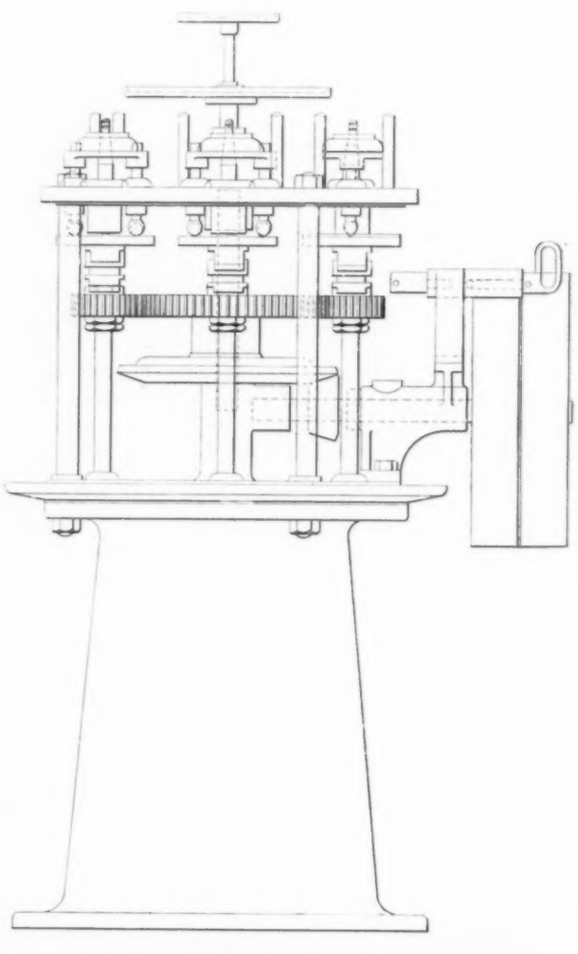


FIG. 2. DETAILS OF THE COCK GRINDER

the large gear having a 5-inch bearing in each side of the column. The gears, shown on the middle shaft, are readily shifted into mesh with either of the gears above so that two speeds are readily obtained. The hand wheel on the broad-faced gear allows the train to be turned by hand so as to mesh readily at any point.

The illustration shows the shaper with the gear casing removed. The shaper shown is a 14-inch, and is made by the John Steptoe Shaper Company, Cincinnati, O.

A New Bearing Metal

The endeavor to find a mixture of metals which will give the least resistance to motion, wear longest and sustain heavy loads has led to the making of many formulas for bearing metal under the general name of "babbitt." The latest claimant for favor has been put out by the Reeves Pulley Company, Columbus, Ind., and has been called the Reeves bearing metal as a distinguishing trade name. It has been made especially for general machine and factory use, and is put up in bars of convenient size, packed 50 pounds to the box.

The Industrial School System of Munich

A study of the industrial-school system of the city of Munich, Germany, has been made during this past summer by Doctor Haney, secretary of the National Society for the Promotion of Industrial Education. This investigation was made one feature of a European trip which included attendance, on the part of Doctor Haney as a delegate at the Third International Congress for the Development of Drawing and Art Teaching and their Application to Industries, which met in London during August last. It is pleasing to note that at the Congress the American exhibit was treated with marked courtesy. It was hung in a room through which everyone had to pass in order to reach the rest of the exhibition.

Doctor Haney states that the school system of the city of Munich ranks high among those of German cities. Following the kindergarten grades, all students enter the *Folkschule* or the public school. Here the instruction is common for students who are ultimately to enter a profession, or a trade, up to their ninth or tenth year. At that time a decision must be made by the child's parent as to whether he is to enter a profession or become an artisan, for from this point on the education is specialized leading to a profession, or to a trade, as the case may be. Boys who are to enter professional life leave the *Folkschule* at the age of nine or ten, and enter the *Gymnasium*. This school's courses correspond to those of the higher grades of our grammar schools, high schools and preparatory schools for the universities. From the *Gymnasium*, the pupil goes to the university. Germany has no schools of higher education which resemble our colleges as differentiated from our universities. The age of leaving the *Gymnasium* is 18 or 19.

On the other hand, a boy who is to learn a trade remains in the *Folkschule* until he is 14 years of age. At this time he is apprenticed to a trade, and spends five days per week in working and one day per week in studying at what are known as "continuation schools." Munich has three of these "continuation schools," housed in superb buildings, each one of which contains a score or more of rooms. Each room is fitted up and devoted to a single trade, as for the trades of machinist, carpenter, bricklayer, printer, and the like. Attendance at this school is for a full working day of the same number of hours as are spent in daily work at the trade; or, say, from 7 in the morning until 6 in the afternoon. Here, instruction is given in the theory of the trade, and in the execution of difficult work such as would not come to an artisan under ordinary circumstances. Every boy learning a trade must attend this school one day a week for three full years. The attendance is compulsory by law, and heavy fines are provided for an employer who fails to send an apprentice to this school.

The line between the two classes of instruction (for a profession or avocation) is very sharply drawn, and it is very difficult to change from one to the other after the decision is made by a boy's parents when he is some 9 or 10 years old. This rigid feature is not entirely approved of by all Germans. Still, manufacturers and trade unions alike approve the system, and large sums have been spent in buildings and equipment.

In addition to this day instruction for apprentices, the "continuation schools" have evening and Sunday classes for persons who are farther advanced in their knowledge of a trade. These classes teach the technique of the trade and aim to develop the highest possible skill and perfection among those who attend. A small fee is charged for attendance at these schools.

The education of girls is similar in character to that which has been outlined for boys. In the higher years of the Folk schools girls take up cooking, domestic science, nursing, and the like. The equipment of the kitchens in these schools is elaborate in the extreme. An interesting point that differs from American practice is that the girls are taught to cook over coal fires, as coal is the universal fuel throughout Germany. In America, cooking schools usually teach girls to cook over gas, a condition which is not duplicated in homes outside of the cities. In connection with some of these schools, kitchen gardens are carried on. These furnish a certain proportion of the supplies that are used in the cooking classes. Higher "Daughter Schools" offer additional training in the domestic arts to girl graduates of the Folk schools.

Manual training in wood and metal working is offered boys in the last year of the Folk school. Cooking is similarly offered to the girls. The manual work is all in the form of "exercises" not completed models. In general, the technical training of the continuation school is also in the nature of exercises rather than in doing commercial work. Thus, in woodworking, a boy will be taken through the various stages of learning the use of tools and then set to making details of furniture, as joints of various kinds, the corner of a chair showing the meeting of the seat and legs, the corner of a table showing the meeting of top and legs, details of finish, trim, and the like; that is, instead of making finished commercial articles, as is done in some of the manual training schools of America, details only are worked out. Great precision and nicety of execution are required. For purposes of illustration, elaborate dissectable models are used. Thus, in teaching carpentry, the instructor will have a complete model of a house, so made that it can be completely taken to pieces, and all the details of construction exhibited before a class. This feature Doctor Haney intends to introduce into some of the manual courses of New York City schools. While exercises are used mainly for instruction, one interesting exception is worthy of notice. In one of the "continuation schools" there was on exhibition a group of some 30 chemical balances that had been made by the students, and which were to be used in one of the neighboring technical high schools. These balances had an excellent finish, and as great accuracy as the best of chemical balances produced by instrumentmakers. They had been made by apprentices in the higher classes.

A great point is made of the teaching of mechanical drawing, in connection with the instruction in all the trades. In this work preciseness of execution is emphasized.

For boys who are to enter business or commercial life, special commercial schools are provided, that are entered after leaving the public school or *Folkschule*. Similar arrangements are made for boys, who desire technical education, to enter the "technical high schools."

Doctor Haney also mentioned the municipal exhibition of manufacturers, which was open in Munich at the time of his visit. This exhibition was taken part in by all of the industries of the city. The scheme of exhibition was far different from that of the average exhibition and is peculiarly commendable. Instead of

arranging given objects in groups, everything was exhibited under conditions of use; that is, machinery was actually shown under working conditions, and with a shop setting suited to its use while the furniture exhibition was in a series of some twenty completely furnished rooms.

A Discussion of Trussed Beams

By E. H. Fish

Some 50 years ago my father, who was a blacksmith, was doing the iron work for a large building in Worcester under an architect who was considered one of the best. To support one hall over another he proposed to use wooden timbers supported by truss rods. In order to keep as much clear head room as possible, he ran the truss rods from the top at the ends to the bottom of the beam at the center. This gave the truss rods a drop equal to the depth of the beam but applied them eccentrically at the ends. My father refused to take any responsibility for the job, claiming that the beams so trussed would be little, if any, stronger than without the rods. In support of his contention he made a small trussed beam in the way indicated and compared it with a beam made from the same stick of wood but without rods. Both broke at very nearly the same load. I might say that the beams as designed were used in the building, but within the last year or two they have been replaced by steel girders. A great many such beams are used but

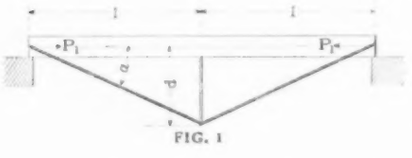


FIG. 1

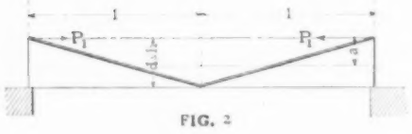


FIG. 2

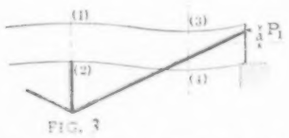


FIG. 3

DIAGRAMS ILLUSTRATING TRUSSED BEAMS

so far as I have been able to find there is no printed discussion of their properties.

Trussed Beams in General

The usual type of trussed beam is shown at Fig. 1. Here the length is given as $2l$, depth of the truss below ends of the truss rod as d. The rods run from the center of the depth of the beam. The angle of the two rods with the horizontal, α, has for its tangent $\frac{d}{l}$. If the load is assumed to be uniformly distributed the supporting force on the strut at the center is $\frac{10}{8}\ w\ l$, provided the center of the beam is held up to the level of the ends. The forces acting on the beam are; the load itself, tending to bend the beam, whose maximum is at the center and is $\frac{1}{8}\ w\ l^2$, and whose next largest value is at $\frac{3}{8}\ l$ from the ends where it is $9\frac{2}{3}\ w\ l^2$, and the compressive force brought on the beam by the tie rods. The fiber stress induced by the direct bending of the beam at its center is

$$p = \frac{w\ l^2}{8}\ \frac{e}{I}, \qquad (1)$$

where $\frac{e}{I}$ is the reciprocal of the section modulus found in Carnegie and other hand books. The downward thrust of the center strut is $\frac{10}{8}\ w\ l$ which, in turn is carried by the two rods. That is, the vertical components of the tensions in the two rods is $\frac{10}{8}\ w\ l$, or

$$2\ T\ sin.\ \alpha = \tfrac{10}{8}\ w\ l,$$

where T is the tension in each rod.

The thrust along the beam P_1 is $T cos.\ \alpha$, or

$$P_1 = \tfrac{5}{8}\ w\ l\ \frac{cos.\ \alpha}{sin.\ \alpha} \text{ or } \tfrac{5}{8}\ \frac{w\ l}{tan.\ \alpha}. \qquad (2)$$

This is uniformly distributed over the entire area (if the beam is held straight and the rods are fastened opposite the center of gravity of the cross section) so the fiber stress is

$$p_1 = \tfrac{5}{8}\ \frac{w\ l}{F\ tan.\ \alpha}. \qquad (3)$$

Thus the maximum fiber stress is at the bottom of the beam over the center strut where it is

$$\frac{w\ l^2}{8}\ \frac{e}{I} + \tfrac{5}{8}\ \frac{w\ l}{F\ tan.\ \alpha}. \qquad (4)$$

If there was no middle support, that is, if we were considering a beam of length $2l$ uniformly loaded and without a truss, the maximum fiber stress would occur at the center and would be equal to

$$\frac{w\ l^2}{2}\ \frac{e}{I}. \qquad (5)$$

Comparing this with equation (4) we see that it might be possible that the second part of equation (4) (the compression) might be so large that the beam would be as weak with the truss as without. This condition would be attained when (5) and (4) are equal, or when

$$\tfrac{3}{8}\ w\ l^2\ \frac{e}{I} = \tfrac{5}{8}\ \frac{w\ l}{F\ tan.\ \alpha}. \qquad (6)$$

If the beam is some structural shape this condition may be found by a knowledge of $\frac{I}{e}$ and F from the tables of properties of rolled sections. If the section is rectangular so that

$$\frac{I}{e} = \frac{b\ h^2}{6} \text{ and } F = b\ h,$$

then equation (6) reduces to

$$d = \tfrac{5}{12}\ h. \qquad (7)$$

From which it appears that a beam may be strengthened by trussing it without running the truss rods below its bottom

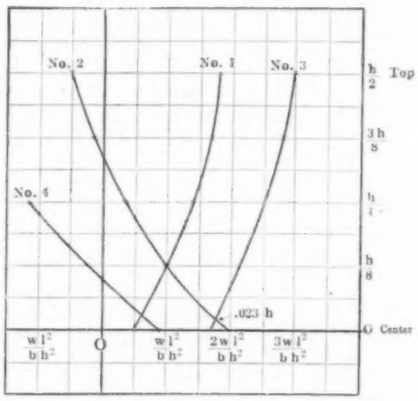


FIG. 4. STRESSES AT THE CRITICAL POINTS FOR VARYING VALUES OF A AND H

provided the ends of the rods are opposite the center of depth of the beam.

If the truss rods are not fixed opposite the center of the beam then there is an additional fiber stress due to the eccentricity of the compression on the beam. If we let the distance from the center of the beam at which the rods are applied be a, then

$$P_1\ a = p_{11}\ \frac{I}{e},$$

or since

$$P_1 = \tfrac{5}{8}\ \frac{w\ l}{tan.\ \alpha},$$

$$p_{11} = \tfrac{5}{8}\ \frac{w\ l^2\ a}{d}\ \frac{e}{I},$$

which is a compressive force on the side of the beam toward which the distance a is measured, and tension on the other side. If the beam is rectangular this may be written

$$p_{11} = \tfrac{15}{4}\left(\frac{w\ l^2}{b\ h^2}\right)\left(\frac{a}{d}\right).$$

Critical Points

Now there will be four points (Fig. 3) where fiber stresses may become dangerous, 1, 2, 3, and 4. Of course, there are points on the other side of the center corresponding to 3 and 4, where the stresses are the same.

These stresses for a rectangular beam are

$$p = \tfrac{3}{4}\ \frac{w\ l^2}{b\ h^2} \text{ or } p = \tfrac{27}{64}\ \frac{w\ l^2}{b\ h^2},$$

due to bending,

$$p_c = \tfrac{5}{8}\ \frac{w\ l^2}{d\ b\ h},$$

due to direct compression, and

$$p_{11} = \tfrac{15}{4}\left(\frac{w\,l^2}{b\,h^2}\right)\left(\frac{a}{d}\right),$$

due to eccentricity, all of which come from previous equations by substituting

$$\frac{b\,h^2}{6} \text{ for } \frac{I}{e} \text{ and } \frac{d}{l} \text{ for } tan.\ \alpha.$$

If a is above the center we have the following stresses at (1): Tension due to bending, $\frac{3}{4}\frac{w\,l^2}{b\,h^2}$, compression (direct), $\frac{5}{8}\frac{w\,l^2}{d\,b\,h}$, and compression due to eccentricity, $\frac{15}{4}\frac{w\,l^2}{b\,h^2}\frac{a}{d}$.

If we write tensions as positive and compressions as negative and combine these stresses we have for

$$p_{total} = \tfrac{3}{4}\frac{w\,l^2}{b\,h^2} - \tfrac{5}{8}\frac{w\,l^2}{d\,b\,h} - \tfrac{15}{4}\frac{w\,l^2}{b\,h^2}\frac{a}{d}.$$

which may be written

$$p_{total} = \frac{w\,l^2}{d\,b\,h^2}\left(\tfrac{3}{4}\,d - \tfrac{5}{8}\,h - \tfrac{15}{4}\,a\right)$$

stress at 1.

In the same way we have at 2,

$$p_{total} = \frac{w\,l^2}{d\,b\,h_2}\left(-\tfrac{3}{4}\,d - \tfrac{5}{8}\,h + \tfrac{15}{4}\,a\right);$$

at 3,

$$p_{total} = \frac{w\,l^2}{d\,b\,h^2}\left(-\tfrac{27}{64}\,d - \tfrac{5}{8}\,h - \tfrac{15}{4}\,a\right),$$

and at 4,

$$p_{total} = \frac{w\,l^2}{d\,b\,h^2}\left(\tfrac{33}{64}\,d - \tfrac{5}{8}\,h + \tfrac{15}{4}\,a\right).$$

In these equations for a given beam there are three factors which may be varied p, d and consequently $\frac{d}{e}$ and a. For the case which I started out with the condition is that d shall not bring the truss rods below the level of the bottom of the beam, and, therefore,

$$d = \frac{h}{2} + a$$

I have computed the stresses at 1, 2, 3 and 4 for varying values of a in terms of h and plotted the terms in results of $\frac{w\,l^2}{b\,h^2}$ in Fig. 4. This shows that the fiber stress at point 3 approaches within about 5 per cent. of that in a beam of length $2\,l$ without truss rods and that just above the center (accurately where $a = 0.0229\ h$) is the point where the greatest fiber stress in the beam reaches its lowest value. If a is above this point the greatest fiber stress is at 3; if a is below the greatest fiber stress is at 2. This shows that for all practical purposes the best place for the truss rods is at the center. If they are at the center then the stress on 2 is the greatest one and is $-\frac{2\,w\,l^2}{b\,h^2}$, or practically one-third less than if the beam was not trussed.

In all of the above discussion it has been assumed that the beam is not long enough so that it is necessary to treat a half of it as if it was a long column subject to the direct compressive stress, since it is very seldom that such a long beam would be used in these days of steel girders. It has also been assumed that the center of the beam has been kept up on a level with the ends. If this latter is not done, or if it is allowed to sag at the center it will decrease the load carried by the central support which in turn will decrease the stress on the rods and the direct compressive stress on the beam and also, when the truss rods start from above the center of depth of the beam increases the eccentricity of that load. Very slight changes in the hight of the center will not make material changes in the fiber stresses, but large ones will render the truss rods useless.

The Design of Band Brakes

By R. A. Greene

The accompanying table, limits and example shows the practice of the Browning Engineering Company, of Cleveland, Ohio,

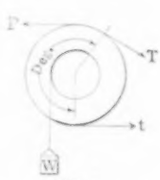


FIG. 1

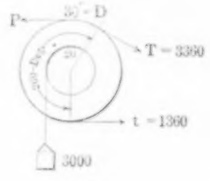


FIG. 2

DIAGRAMS ILLUSTRATING DESIGN OF BAND BRAKES

in regard to the design of band brakes. Referring to Fig. 1 the equations are:

$$T = P\,x,$$

$$t = T - P,$$

$$S = \frac{2\,T}{D \times F}.$$

$$\mathfrak{P} = S \times D \times 0.262 \times \text{revolutions per minute.}$$

In which

T = The greater tension on the band in pounds,

t = The lesser tension on the band in pounds,

P = The equivalent load on the brake drum in pounds,

X = A factor from the accompanying table,

D = The diameter of brake drum in inches,

F = The width of face of brake drum in inches,

S = A checking factor which has a maximum limit of 65.

$\mathfrak{P}$ = A checking factor which has a limit of 54,000 Yale & Towne practice, or 60,000 Brown hoist practice.

The factor $X = \frac{N}{N-1}$ in which $log.\ N = 10^{2.7288\ f\ c}$, where f = the coefficient of friction and c the length of arc of contact in degrees divided by 360.

An Example

Referring to Fig. 2, let us assume that a band brake is to be designed having an arc of contact of 260 degrees, a coefficient of friction of the braking surfaces of 0.2 with a brake drum diameter of 30 inches, face of 4 inches, a speed of 100 revolutions per minute, and a shaft or axle load of 3000 pounds acting on a diameter of 20 inches.

Then

$$P = \frac{3000 \times 20}{30} = 2000 \text{ pounds},$$

$X = 1.68$ (from table),

$T = 2000 \times 1.68 = 3360$ pounds,

$t = 3360 - 2000 = 1360$ pounds,

$$S = \frac{2 \times 3360}{30 \times 4} = 56 \text{ (within the limit)},$$

$\mathfrak{P} = 56 \times 30 \times 0.262 \times 100 = 44{,}000$ (within the limit).

Degrees.	X		
	$f = 0.2$	$f = 0.3$	$f = 0.4$
180	2.14	1.64	1.40
195	2.03	1.56	1.35
210	1.93	1.50	1.30
240	1.76	1.40	1.23
250	1.72	1.37	1.21
260	1.68	1.35	1.19
270	1.64	1.32	1.18
280	1.60	1.30	1.17
290	1.57	1.28	1.15
300	1.54	1.26	1.14

TABLE GIVING VALUES OF FACTOR X FOR DESIGNING BAND BRAKES.

The Band Saw as a Machine Tool

By Philip Bellows

While passing through a large American machine shop recently I was impressed by the presence of a band saw that seemed to have missed its way from the pattern shop and got entangled among the milling machines, planers, etc. Upon inquiry I was told that the master mechanic, who was comparatively new to the place, had caused the machine to be installed about six months before to handle a certain class of work that had formerly been done in the lathe.

In the shop referred to, a large amount of rolled brass is used for various purposes and previously this was handled in the shears and on the face plate of the lathe, or in the drill press according to which one suited the particular job in hand. A great deal of zinc plate is also used, about ½ inch thick, which is turned into disks. Previously the method of procedure was to bolt a plate on the face plate of the lathe and cut out the disk with a tool. Now, however, all rolled brass up to ⅛ inch thick and zinc plates up to ½ inch thick are marked and

brought to the band saw, which saws them like soft pine boards.

The best kind of saw blade for this work is one about ½ inch wide, 1/32 inch thick and with the teeth set very fine; that is, to make the width of the cut about three-sixtyfourths of an inch. The teeth should be small so that the work upon each individual tooth will be light. Such a tool is in reality a straight milling cutter. Rolled brass up to the thickness mentioned may be cut very fast; when cutting thicker plates a slower feed should be taken, but the saw should not be expected to cut thick plates in any case. Cast brass and bronze should not be used.

Some difficulty was at first experienced through the cuttings passing through the saw slot, coming between the saw and the lower wheel and becoming imbedded in the rubber band cemented to the wheel. As soon as this was discovered, connection was made with the compressed-air line and a fine jet of air blown onto the surface of the wheel where the wheel and band saw meet and this keeps the former clear of all small specks of metal.

Tests made in my presence showed the following results: The wheel of the saw ran at 460 revolutions per minute for the saw blade. A strip of brass 13 inches long was fed to the saw and was split down the middle in three sections, equivalent to a cut of 21⅔ feet per minute. A cut 2 feet long in a zinc plate ½ inch thick occupied seven seconds by a stop watch, or equal to a cut of 17 feet per minute.

The operator showed no signs of fear in these tests as he drove the metal strips along like wood. From a more or less intimate acquaintance with band saws and their antics when unkindly treated, I expected a more humble attitude toward the saw, on the part of the man doing the work, than was the actual case.

The saws used last on an average a little more than a month apiece, which is very remarkable considering the fact that in that time their cut runs up to a total of from 40,000 to 70,000 feet. One thing that favors the metal-cutting saw is the evenness of texture of the material; no knots and no false spots, as in wood. I noticed that the band wheels on this saw, and on all other band saws in the same plant, had wooden rims. It was pointed out to me that these are invariably specified when such machines are ordered, as it is much easier to cement the rubber face which carries the saw to such a rim than to the much commoner type of iron rim.

Business Items

American Blower Company, Detroit, Mich., reports the receipt of a large number of important contracts since September 1.

Owing to the increase in demand for the Gridley multiple spindle automatic lathes, the Windsor Machine Company, Windsor, Vt., has found it necessary to build an addition to its erecting department 50x100 feet.

It has been erroneously reported that The Franklin Moore Company, Winsted, Conn., has disposed of its plant to the Sessions Foundry Company, Bristol, Conn. It has sold only its foundry, this in order to be able to give more attention to their crane, chain block and bolt business.

The Metal Hardening Solution Company, Rochester, N. Y., has found it necessary to establish a laboratory for the manufacture of "Kalux" steel hardening and tempering solution in Toronto, Ont., in order to care for and insure prompt attention to the increasing demand for their product in the Dominion of Canada. The Canadian address for the present is F. W. Sangster, 4 Toronto street, Toronto, Ont.

Trade Catalogs

W. N. Durant Company, Milwaukee, Wis. Catalog of counting machines. Illustrated, 16 pages, 3½x6 inches, paper.

The Hill Clutch Company, Cleveland, Ohio. Catalog describing collar oiling bearings. Illustrated, 40 pages, 5½x8 inches, paper.

The Quality Saw and Tool Works, Inc., Springfield, Mass. Catalog of hack saw blades. Illustrated, 10 pages, 3½x6 inches, paper.

The Cincinnati Planer Company, Cincinnati, Ohio. Catalog No. 10, describing variable speed planers. Illustrated, 56 pages, 6x9 inches, paper.

The Springfield Machine Tool Company, Springfield, Ohio. Catalog of lathes, shapers, straightening and power presses. Illustrated, 9½x12 inches, paper.

Westmacott Gas Furnace Company, Providence, R. I. Catalog of gas furnaces for hardening, annealing, melting, etc. Illustrated, 40 pages, 6x9 inches, paper.

Jacobson Machine Manufacturing Company, Warren, Penn. Bulletin K, describing gas and gasolene engines at electric lighting service. Illustrated, 24 pages, 6x9 inches.

Diamond Saw and Stamping Works, Buffalo, N. Y. Catalog No. 14, describing "Sterling" hack saw blades and frames, power machines, etc. Illustrated, 20 pages, 5x8 inches, paper.

The Fay Machine Tool Company, Philadelphia, Penn. Catalog of automatic lathe, cam cutter, drilling, threading and nut tapping machines. Illustrated, 20 pages, 6x9 inches, paper.

Business Opportunities

Neill Black, Manchester, N. C., will rebuild sawmill recently burned.

The Oakland Motor Car Company, Pontiac Mich., will double its plant.

A. J. Brown, Lufkin, Texas, will establish sawmill at Clark's Ferry, Tex.

The box factory of Atwood & McManus, Chelsea, Mass., was destroyed by fire.

The Wilma Machine Company, Carthage, N. Y., will erect a new foundry and machine shop.

Unity Cotton Mills, Lagrange, Ga., will build another plant, it is said, at a cost of over $400,000.

The Textile Company, Lockport, N. Y., will build an addition doubling the capacity of plant.

Hope Mills (N. C.) Real Estate and Investment Company contemplates establishing hosiery mill.

Champion Lumber Company, Poplarville, Miss., will rebuild sawmill recently destroyed by fire.

Old Dominion Iron and Nail Works, Richmond, Va., will rebuild horseshoe mill recently burned.

The Peck-Hammond Company, Cincinnati, Ohio, manufacturers of heating furnaces, will enlarge plant.

A plant is being erected for the Badger Malleable and Manufacturing Company, at South Milwaukee, Wis.

Des Arc (Ark.) Lumber and Handle Manufacturing Company will install sawmill and woodworking plant.

N. L. Moore, Humboldt, Tenn., will form company to establish a plant for the manufacture of oil stoves.

The plant of the South Bay Canning Company, at Picton, Ont., was destroyed by fire. Loss, about $50,000.

The National Hollow Brake Beam Company, of Chicago, Ill., will move to Joliet, where a new plant will be erected.

The woodworking plant of E. J. Bailey, Brocton, N. Y., was destroyed by fire, causing a loss of about $15,000.

The Hays Manufacturing Company, Erie Penn., will erect a $15,000 addition to its foundry and machine shop.

The Oklahoma Street Railway Company, Oklahoma City, Okla., will erect car barn, woodworking and iron shop.

The Chicago, Rock Island & Pacific Railway Company will erect terminals at El Dorado, Ark., and Winnfield, La.

Eichman Manufacturing Company, Baltimore, Md., will establish plant for the manufacture of plumbers' specialties.

The A. H. Nilson Machine Company, Hartford, Conn., has let contract for the construction of an additional factory.

Plans are said to be completed for a new concrete roundhouse for the Bessemer & Lake Erie Railroad, Pittsburg.

The Western Lock and Hardware Company, Los Angeles, Cal., will locate in Riverside, where a plant is being erected.

Plans have been completed for a new plant for the Lincoln Furniture Company, Philadelphia, Penn., to cost $250,000.

The Bevin Bros. Manufacturing Company, makers of bells, will erect an addition to plant at East Hampton, Conn.

It is reported that the Englewood Hoop Company, Englewood, La., will establish loop plant and sawmill at Tallulah.

It is reported that a large steel plant and bar mill will be erected by the Upson Nut Company, at Cleveland, Ohio.

The Wisconsin Automobile Supply Company, Two Rivers, Wis., will put up a plant for manufacturing a new auto truck.

It is reported that the Fort Worth (Tex.) Rolling Mills will install machinery for the manufacture of cotton ties.

It is reported that the Reading (Penn.) Iron Company is negotiating for a site for the purpose of enlarging the sheet mill.

The plant of the North Fork Lumber Company at North Fork, Wis., was destroyed by fire. Loss, about $100,000.

The Pence Automobile Company, Minneapolis, Minn., will build a six-story building to be used as a storage and repair shop.

The F. E. Schoenberg Manufacturing Company, St. Louis, Mo., will erect a factory for the manufacture of screens.

It is reported that G. J. & H. Lange, who operate a canning factory at Eau Claire, Wis., will establish one in Ashland.

The carriage factory of Alanson E. Hallock at Smithtown Branch, L. I., was destroyed by fire, causing a loss of $25,000.

Fire partly destroyed the plant of the Victor Manufacturing Company, Leavenworth, Kan., maker of washing machines.

The Pfau Manufacturing Company, Cincinnati, Ohio, will erect a plant in Norwood at a cost of $100,000. This will include main factory, brass foundry, power house, etc.

The Standard Sanitary Manufacturing Company will erect an addition at its plant in New Brighton, Penn., to be used as a foundry. This with equipment will cost about $100,000.

It is reported that the Simplex Manufacturing Company, of Thompsonville, Conn., may move to Granby. The company manufactures envelope-sealing machines, coin separators, etc.

Ground has been broken for the new $1,000,000 wire mill to be erected for the Wisconsin Steel Company in Chicago. This is a subsidiary company of the International Harvester Company.

Plans have been filed for a new car barn for the Metropolitan Street Railway Company, New York, which will cost over $400,000. Adrian Joline and Douglas Robinson are receivers of this company.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., October 26 for piston pump, plate straightening machine, generators and engines, electrical supplies, babbitt metal, brass and copper tubing, chain, leather belting, hammers, saws, ratchet drills, blow torches, stocks and dies, taps, water gages, gage cocks, grease cups, ball bearings, screws, etc., as per Circular No. 472.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open following bids: October 13—Exhaust blowers (schedule 408), lubricators (schedule 406), drilling machine (schedule 394), bolts and nuts, taps, wrenches (schedule 407), machine steel (schedule 406), pipe fittings (schedule 409 and 405). October 27—Foundry furnace (schedule 398), bolts and nuts, machine screws (schedule 416), bolt cutter, floor grinder, 72 inch lathe, shaping machine (schedule 418).

Want Advertisements

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents. Only bona fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper list free. E. G. Smith Co., Columbia, Pa.

Small, accurate drill jigs and dies built to order. R. Rosner, Madison, Wis.

Steel case hardened; modern methods. Boston Gear Works, Norfolk Downs, Mass.

Tools and fixtures designed for interchangeable work. Fred L. Fay, Wilmington, Del.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Wanted—Orders for brass goods. Castings and finished product. Box 486, AMER. MACH.

Hand power bending tools, labor-saving, money-making. Estep & Dolan, Sandwich, Ill.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J

Machines designed; automatic, special. Practical working drawings. C. W. Pitman, 3519 Frankford Ave., Philadelphia, Pa.

Special machinery accurately built. Screw machine and turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

For any machine or small tool firms not yet represented in France please apply to "Société Francaise de Machines-Outils, 3, Rue Arséne Houssaye à Paris."

Wanted—A large pumping station for pumping natural gas. Inquire Pittsburgh Plate Glass Company, Room 1624, Frick Building, Pittsburg, Pennsylvania.

Special machinery and duplicate machine parts built to order; tools, jigs and experimental work; complete modern equipment. MacCordy Mfg. Co., Amsterdam, N. Y.

Wanted—Articles to manufacture by contract or will buy patent, tools and fixtures outright, by a manufacturer having a large and well equipped plant and capital. Address Box 564, Erie, Pa.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

Machinery built to order and by contract; special parts made; gear cutting, automobile and pattern work, punch press and screw machine work, tools, dies, etc. Blair Tool and Machine Works, West and Morris Streets, New York City.

Patent & Designs Act, 1907—A leading firm of machine tool makers are prepared to undertake the manufacture for patentees of any suitable articles (preferably machine tools), which must be made in Great Britain under the provisions of the above act. Apply Box 474, AMERICAN MACHINIST.

Great chance for a large machine manufacturer or capitalist. Will sell patents for U. S. outright for several new machines which will revolutionize the leather trade. Machines are already selling well in Europe. Construction drawings, patterns, catalogs, cuts, etc., on hand. Large profits. Box 518, AMER. MACH.

Wanted—Patented article that can be used in machine shop boiler room, or engine room. Must have merit. We possess finest facilities for marketing, having a large force of traveling men in this country, and agents in nearly every large city in Europe, who call upon steam users and machine shops. Liberal contract. Highest of references. Address Diamond Power Specialty Co., 236 Fort St., W., Detroit, Mich.

Situations Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

High grade superintendent wants good position; up in recent methods in all departments. Energetic, executive, a producer. Box 532, AMERICAN MACHINIST.

Practical mechanic desires a change of position. Would accept one of master mechanic, assistant superintendent or general foreman. Age 35; 15 years' experience. Am a tool maker, machine designer; also expert on tools and fixtures. Inspector of tools and fixtures, hand and automatic screw tools (special equipments), structural work. References. Box 325, AMERICAN MACHINIST.

MARYLAND

Superintendent or works manager, practical mechanic with executive ability and capacity to handle a large plant. References. Box 536, AMERICAN MACHINIST.

MASSACHUSETTS

Who wants a boss toolmaker; 20 years' experience. Box 530, AMERICAN MACHINIST.

Position as superintendent or master mechanic with large growing concern in this country or foreign, Japan preferred. Years' experience with government work: can produce results. Box 535, AMERICAN MACHINIST.

NEW JERSEY

Superintendent, age 35, 17 years' practical experience, expert jig designer, desires responsible position. Best references. Box 528, A. M.

Position as toolmaker for automatic screw machine room. Years of experience as an operator, machinist and toolmaker. Box 517, AMERICAN MACHINIST.

NEW YORK

A superintendent or manager; good mechanic and executive. Box 511, AMERICAN MACH.

First class draftsman, Corliss or high speed engines, wants to change position. Box 533, AMERICAN MACHINIST.

Mechanical draftsman, now employed, wants position in or near New York City. Five years' experience on special machinery. Box 526, AMERICAN MACHINIST.

Competent, capable mechanical draftsman with five years' experience along general lines. Technical graduate, accurate, quick worker, desires change at $18.00 to start. Box 513, AMERICAN MACHINIST.

Draftsman, with 14 years' shop and office experience, locomotive design, special work, systematic rearrangement of equipment in machine, boiler shops, etc., to reduce unapplied labor and increase output. Box 506, AM. MA.

OHIO

Wanted—Position as foreman by first class machinist, competent to fill high grade position. Good draftsman, college education, married, age 39, references. H. O. Lane, Hillsboro, O.

PENNSYLVANIA

$2400.00 man wants agency or will travel in any location in the United States or abroad. Wide domestic and foreign mechanical experience. Highest references. Box 531, AM. MACH.

Expert cost accountant and systematizer desires an executive connection with manufacturing concern. Up-to-date methods and satisfactory results guaranteed. Box 304, AMERICAN MACHINIST.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

First class bolt and screw header operator wanted for continuous work on a Standard No. 4 header. Young man with executive ability preferred, as opportunity for advancement to position of foremen will be open. Wages $2.50 per day while operating header. State age, experience and references. Post Office Box 287. Hartford, Conn.

ILLINOIS

Wanted—Working foreman to take charge six to ten toolmakers. Permanent position. State experience and wages. Box 512, AM. MA.

Wanted—Mechanical superintendent for large plant in Chicago suburb. Must be good executive and systematizer, capable of handling 1000 men; one with gasolene and automobile engine experience preferred. State qualifications, salary wanted, full particulars. Excellent opportunity for right man. Box 520 AMERICAN MACHINIST.

INDIANA

A patternmaker for gasolene engine work, good wages. Box 484, AMERICAN MACHINIST.

Wanted—Six good lathe men and four good toolmakers, steady work on gasolene engines. Box 519, AMERICAN MACHINIST.

MICHIGAN

Wanted—Experienced office and road sales manager for line of marine gasolene engines, one with manufacturing experience preferred; established business. Address fully, enclosing photograph, "Western House," Box 527, AMERICAN MACHINIST.

NEW YORK

A high grade man to fill the position of mechanical superintendent. Must be a hustler. Address, stating references and salary expected, Box 529, AMERICAN MACHINIST.

Wanted—Brass foundry foreman, none but experienced man need apply; one familiar with the valve business preferred. In replying, state if now employed, age, wages expected. Box 521, AMERICAN MACHINIST.

A draftsman familiar with traction and portable engine boiler work. Reply fully stating age, education, experience, past employers, work done, married or single, salary wanted. Address Box 524, AMERICAN MACHINIST.

Wanted—Draftsman and mechanical engineer to design and sell valves for water works exclusively. Replies confidentially treated which as to state details of experience and salary required. Box 522, AMERICAN MACHINIST.

Wanted—Young man as assistant foreman of woodworking shop. Must have knowledge of up-to-date woodworking practice and the economical cutting and handling of stock. Experience on wood patterns and mold boards desirable. Box 523, AMERICAN MACHINIST.

Wanted—Mechanical engineer and salesman with shop experience preferred. Must be familiar with special machinery designing, and competent to estimate on work and follow up new business when required. Opportunity with future for right man. Address with full particulars as to experience, age, nationality, references and salary expected to start. Box 515, AMERICAN MACHINIST.

Wanted—Superintendent experienced in manufacture of automatic and special machinery. Must be first class mechanic and executive, familiar with modern shop methods. Progressive man with push and ability will find this unusual opportunity with rapidly growing business. Give full particulars stating age, experience, references and salary expected to start. Box 516, AMERICAN MACHINIST.

PENNSYLVANIA

Wanted—Mechanical draftsman, young man familiar with high speed steam engines. Excellent opportunity for the right party to work into leading position. To receive consideration give full details of experience, length of engagements, salary received, etc. Box 534, AM. MA.

For Sale

Classification indicates present address of advertiser, nothing else.

For Sale or Rent—Foundry, machine and wood shops with machinery in town of 5000. Box 227, Bergen, N. Y.

For Sale—Two 50-horse power tubular steel boilers in first-class condition. Will sell cheap. Address R. Kirshbaum & Son, Indianapolis, Ind.

For sale, absolutely new, a No. 2½ heading machine and a No. 2½ reheading machine, Waterbury-Farrel make, never used. Ohlen Company, Box 740, Columbus, Ohio.

Steam Plant for Sale—22x48 Wetherill Corliss engine. Cost $3350; sell $1500. Two tubular boilers, 66"x18'. Cost $1000 each; sell $450 each. F. O. B. cars Chester, Pa. All in good condition. Keppel & Co., Chester, Pa

For Sale—The complete outfit for manufacturing the best granulated and plastic metallic packing in the world for steam, air and ammonia. Established 12 years. No experience required. Just the thing in connection with a machine shop. Address P. O. Box 24, South Stillwater, Minn.

For Sale—Tracings, patterns, jigs and templets for the following size gas and gasolene engines: 1½, 3 and 5 horse-power vertical and 3, 5, 8, 10, 12, 16 and 20 horse-power horizontal; also a number of finished and unfinished engines of the above sizes. All of the above sizes have been in successful operation for several years. This is a splendid opportunity for anyone wishing to build gas or gasolene engines. You can save thousands of dollars in experimental work by purchasing this complete outfit. Shop rights of valuable patents on these engines will be given to purchaser. Box 366, AMERICAN MACHINIST.

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Marshall & Huschart Mch. Co.	91
Massachusetts Saw Works	92
McCabe, J. J.	14 and 90
McInnes Steel Co., Ltd	83
Merritt, Jos	36
Merritt & Co	89
Metal Hardening Solution Co.	83
Milton Mfg. Co	67
Mitts & Merrill	74
Morrow Mfg. Co	93
Morse Chain Co	64
Morse Twist Drill & Mach. Co.	47
Morton Mfg. Co	89
Motch & Merryweather Machinery Co	91
Mueller Mach. Tool Co	71
Mummert, Wolf & Dixon Co.	61
National Acme Mfg. Co	94
National File and Tool Co	68
National Machinery Co	89
Newark Gear Cutting Machine Co	81
New Britain Machine Co	70
New Haven Mfg. Co	68
New Metal Tool Steel Co	82
New Process Raw Hide Co	81
Newton Machine Tool Works	11
Nicholson & Co., W. H	74
Nicholson File Co	17
Niles-Bement-Pond Co.,	31, 32, 33, 34 and 90
Nolte Brass Co	92
Northern Electrical Mfg. Co.	86
Northern Engineering Works.	76
Norton Co	57
Norton Grinding Co	56
Nuttall Co., R. D	80
Obermayer Co., S	85
O. K. Tool Holder Co	88
Parker Co., Chas	77
Pawling & Harnischfeger	76
Paxson Co., J. W	82
Philadelphia Bourse	70
Philadelphia Gear Works	80
Pierome Hide Co	80
Potter & Johnston Mach. Co.,	20 and 21
Powell Tool Co	94
Pratt Chuck Co	79
Pratt & Whitney Co.	2 and 3
Prentice Bros. Co	27
Prentiss Tool & Supply Co.	90
Q. C. Machine Tool Co	61
Quality Saw and Tool Works	84
Ransom Mfg. Co	60
Reed Co., F. E	47
Reed Mfg. Co	77
Reichhelm & Co., E. P	75
Reynolds Machine Co	88
Rivett Lathe Mfg. Co.	3d cover
Rockford Drilling Machine Co.	64
Rockwell Furnace Co	82
Rockwood Mfg. Co	76
Rogers & Hubbard Co	83
Rogers Wks., John M	75
Root Co., C. J	61
Roth Bros. & Co	87
Safety Emery Wheel Co	60
Saunders Sons, D	72
Sawyer Gear Works	80
Schieren Co., Chas. A	74
Schuchardt & Schutte,	74 and 85
Schumacher & Boye	9
Screw Machine Products Corp.	73
Sebastian Lathe Co	25
Sellers & Co., Inc., Wm	30
Seneca Falls Mfg. Co	69
Shepard Electric Crane and Hoist Co	76
Shultz Belting Co	77
Sibley Mch. Tool Co	71
Simonds Mfg. Co.	88 and 89
Skinner Chuck Co	78
Slate Machine Co., Dwight	73
Sloan & Chace Mfg. Co., Ltd.	51
Slocomb Co., J. T	72
Smith Countershaft Co	69
Smith & Mills	92
Smith Co., Wm. J	69
Spacke Mach. Co., F. W	85
Springfield Mach. Tool Co	15
Standard Connecting Rod Co.	62
Standard Engineering Works	61
Standard Gauge Steel Co	81
Standard Tool Co	69
Stark Tool Co	89
Starrett Co., L. S	45
Stoever Fdry. & Mfg. Co	89
Sturtevant Co., B. F	26
Tabor Mfg. Co	65
Tate, Jones & Co	66
Taylor & Fenn Co	72
Taylor-Wilson Mfg. Co	80
Toomey, Frank	91
Triumph Electric Co	87
Trump Bros. Machine Co	78
Tudor Mfg. Co	70
Union Twist Drill Co	49
Universal Machine Screw Co.	66
U. S. Electrical Tool Co	88
U. S. Gas Furnace Co	82
Van Dorn & Dutton Co	81
Van Dorn Elec. & Mfg. Co.	88
Vandyck Churchill Co	66
Vitrified Wheel Co	60
Von Wyck Mach. Tool Co	92
Walcott & Wood Mach. Tool Co.	61
Waltham Watch Tool Co	92
Walton Co., The	73
Ward & Sons, Edgar T	83
Warner & Swasey Co.	1 and 29
Warner Instrument Co	73
Waterbury Farrel Fdry. & Mach. Co	71
Watson Stillman Co	63
Westcott Chuck Co	78
Western Electric Co	86
West Haven Mfg. Co	88
Westmacott Gas Furnace Co.	82
Whitcomb - Blaisdell Machine Tool Co	19
Whitman & Barnes Mfg. Co.	67
Whitney Mfg. Co	41
Whiton Machine Co., D. E	78
Wiley & Russell Mfg. Co	73
Williams & Co., J. H	67
Williamson Vise Co	77
Wilmarth & Morman Co	60
Woodward & Powell Planer Co.	89
Worcester Machine Screw Co.	89
Wormer Machinery Co., C. C.	91
Yale & Towne Mfg. Co	76